Nokia Customer Care

Service Manual

RM-356 (Nokia 5800 XpressMusic; L3&4)
Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	10/2008	ET	

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The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Li-Ion batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77° F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Nokia 5800 XpressMusic; L3&4 Service Manual Structure

1 General Information
2 Service Tools and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF troubleshooting
5 Camera Module Troubleshooting
6 System Module and User Interface
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Product selection

RM-356 is a GSM/HSDPA/WCDMA tri-mode handportable monoblock phone with a person centric touch UI, integrated GPS (A-GPS OMA SUPL), WLAN and a TV-out connection. It supports EGSM850/900/1800/1900 and WCDMA900/2100 bands, and CSD/HSCSD, GPRS/EGPRS, WCDMA/HSDPA data bearers.

For WCDMA the maximum bit rate is up to 384 kbit/s for downlink and 384 kbit/s for uplink with simultaneous CS speech or CS video (max. 64 kbit/s). The HSDPA peak is 3.6 Mbit/s downlink (with limited use cases).

For GPRS/EGPRS networks the RM-356 is a Class B GPRS/EGPRS MSC 32 (5 Rx + 3 Tx, max sum 6) device, which means a maximum uplink speed of 177 kbit/s and downlink speed of 296 kbit/s. RM-356 also supports Dual Transfer Mode (DTM) for simultaneous voice and packet data connection in GSM/EDGE networks; simple class A, multi slot class 11, (4 Rx + 3 Tx, max sum 5).

RM-356 has a large nHD 3.2”(640 x 360 pixels) colour display (active area 39.6 mm x 70.4 mm) with 16 million colors. It also has a 3.2 megapixel autofocus camera with 3 x digital zoom and an integrated dual LED flash.

RM-356 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.3. RM-356 also supports the Bluetooth 2.0 + EDR standard.

RM-356 uses a S60 5.0 operating system and supports the full Web Browser for S60, which brings desktop-like Web browsing experience to mobile devices.

RM-356 also supports MIDP Java 2.0, providing a good platform for compelling 3rd party applications.

NOKIA
XpressMusic
Menu
19:55
Calendar
Contacts
Log
Internet
Messaging
Gallery
Download
Music
Maps
Settings
Help
Applications
Options
Exit

Figure 1 View of RM-356

Product features and sales package

New hardware characteristics

- Touch screen phone:

- Full touch UI – no physical input or UI navigation keys
- Contacts Bar - Person centric UI
- Media Bar – Easy access to media

Bearers and transport

- WCDMA DL 384kbit/s, UL 384 kbit/s
- HSDPA up to 3.6Mbps
- GPRS/EGPRS Class B, Multi slot class 32 (5 Rx + 3 Tx = 6)
- Dual Transfer Mode (DTM) class A, multi slot class 11 (4 Rx + 3 Tx = 5)

Connectivity

- Integrated GPS (A-GPS OMA SUPL)
- TV-out connection
- WLAN IEEE802.11 b/g
- Bluetooth 2.0 (A2DP & AVRCP)
- USB2.0 High Speed with microUSB interface
- MicroSD memory card - support up to 16GB
- 3.5 mm AV connector

Display

- 3.2” nHD (640 x 360 pixels) colour display (active area 39.6 mm x 70.4 mm), up to 16M colors, 16:9 aspect ratio
- Digital Ambient Light Sensor (ALS) – used to optimize display/key brightness and power consumption

Imaging and video

- 3.2Mpix autofocus camera with 3 x digital zoom and an integrated dual LED flash
- True 16:9 high definition widescreen optimised for mobile entertainment
- Video center for enjoying downloaded and streamed content, WMV support, video feeds (vodcasting) and mobile TV (IP TV)
- CS video call
- Video sharing
- Video streaming (3GPP and CIF)

Music

- DAC33 for hi-fi sound quality
- Podcasting, internet radio, best in class music player on the go
- Superb music player UI, bass booster, stereo widening, loudness
- Stereo music player supporting MP3, SpMidi, AAC, AAC+, eAAC+, WMA
- 3D stereo ringing tones, 64 polyphonic Midi, MP3 tones, video ringing tones
- Stereo FM Radio

Productivity

Context management

- Full OMA client provisioning

- PIM (Calendar + Contacts)
- OTA provisioning & over the air SW update (FOTA)
- Nokia PC Suite connectivity with USB, Bluetooth
- Web Browser (OSS), Java ™ MIDP 2.0, XHTML browsing over TCP/IP

Messaging

- MS, MMS (OMA 1.3)
- Native Email and IM client, Email with attachments (push)
- Audio messaging (AMS)

Voice

- Rich Calls: 2-way video conferencing (Video Call), Video Sharing
- Speaker independent dialing and voice commands (SIND)

Add-on software framework

- S60 5.0 OS
- Java: MIDP2.0

Additional technical specifications

- Vibrating alert
- 3GPP Rel 5 compliant
- Speech codecs supported: AMR, NB-AMR, FR, EFR

Sales package

- Transceiver RM-356
- Battery (BL-5J)
- Charger (AC-8)
- Stereo headset (HS-45 + AD-54 audio controller)
- TV-out cable (CA-75U)
- MicroUSB connectivity cable (CA-101)
- Mini DVD
- Extra stylus
- CP-306 plectrum stylus in wrist strap
- CP-305 carrying case
- DT-29 desk stand
- User Guide

Product and module list

Module name	Type code	Notes
System/RF Module	2JD	Main PWB with components.
UI Flex Module	2JY	

Mobile enhancements

Table 1 Audio

Enhancement	Type
Audio controller	AD-54
Hearing aid	HDA-12
Wired headsets	HS-16
	HS-41
	HS-43
	HS-45 (+ AD-54)
	HS-45
	HS-48
	WH-201
	WH-202
	WH-500
	WH-600
	WH-700
	WH-800

Enhancement	Type
Wireless headsets	BH-102
	BH-103
	BH-212
	BH-303
	BH-500
	BH-501
	BH-703
	BH-804
	BH-904
	HS-24W
	HS-25W
	HS-38W
	HS-51W
	HS-52W
	HS-57W
	HS-58W
	HS-59W
	HS-72W
	HS-76W
	HS-79W
	HS-89W
	HS-91W
	HS-94W
	HS-95W
	HS-96W
	HS-100W

Table 2 Car

Enhancement	Type
FM transmitter	CA-300
Mobile holder	CR-39
	CR-82
	CR-99
	CR-103
Mobile holder mounting device	HH-12

Enhancement	Type
Mobile charger	DC-4
Navigation	Nokia 500 Auto Navigation
Wireless car kit	CK-7W
	CK-15W
	CK-100
	CK-300
Wireless plug-in car handsfree	HF-33W
	HF-200
	HF-300

Table 3 Data

Enhancement	Type
MicroSD card, 512 MB	MU-28
MicroSD card, 1 GB	MU-22
MicroSD card, 2 GB	MU-37
MicroSD card, 4 GB	MU-41
MicroSD card, 8 GB	MU-43
MicroUSB connectivity adapter cable	CA-101
Video connectivity cable	CA-75U

Table 4 Messaging

Enhancement	Type
Wireless keyboard	SU-8W
Digital pen	SU-27W
CP-306 plectrum stylus	CP-306

Table 5 Music

Enhancement	Type
Wireless Audio Gateway	AD-42W
Wireless speakers	MD-5W
	MD-7W
Music speakers	MD-6
	MD-8

Table 6 Navigation

Enhancement	Type
Wireless GPS module	LD-3W
	LD-4W

Table 7 Power

Enhancement	Type
Battery 1320mAh	BL-5J
Charging connectivity cable	CA-126
Charger	AC-4
	AC-5
	AC-6C (+CA-100c)
	AC-8
	DC-1
	DC-8
	DC-9
Charger adapter	CA-44
USB charger	CA-100

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight with battery (g)	Volume (cm3)
Transceiver with BL-5J 1320 mAh Li-Ion battery back	111 x 51.7 x 15.5	109	83

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII (900) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900) and WCDMA I (2100)

Parameter	Unit
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA I (2100): 277
Channel spacing	200 kHz

Parameter	Unit
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA I (2100): 75

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by	Music playback
BL-5J	1320	Up to 8.8 h (GSM) Up to 5 h (WCDMA)	Up to 406.2 h (GSM) Up to 400 h (GSM)	Up to 35h

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2 — Service Tools and Service Concepts

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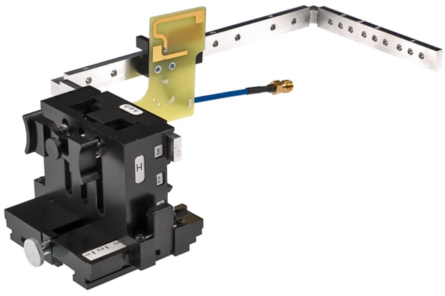
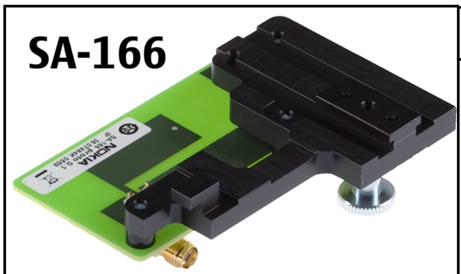
Service tools

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-356. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

FS-77 PROTO N/A FLASH EM-CAL	FS-77	Flash adapter	
	For flashing (also dead phones) with SS-46. RF testing and tuning, and EM calibration on ATO level with SS-62 (mechanical locking concept), CU-4 supported.		
	MJ-165	Module jig	
	MJ-165 is meant for troubleshooting, testing, tuning and flashing on the engine level (CU-4 supported). The jig includes an RF interface for GPS, GSM, WCDMA and Bluetooth.		
RJ-230 Nokia Bochum	RJ-230	Soldering jig	
	RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.		
	SA-131	RF coupler	
	SA-131 is a RF coupler for GPS testing. It is used together with SS-62.		

SA-166



SA-166	RF coupler	

SA-166 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-166 . The setup used for measuring the values is SA-166 + FS-77 + CU-4.

-

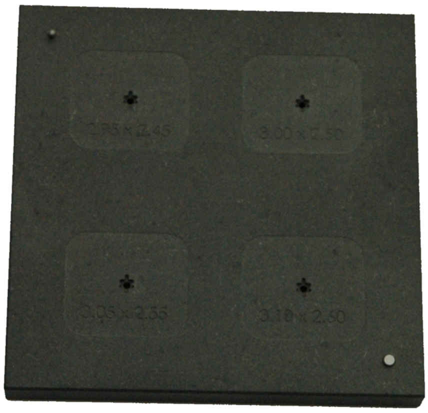
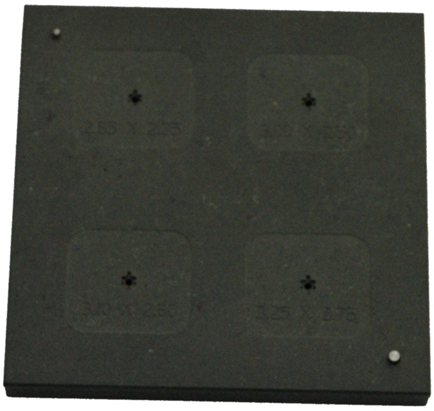
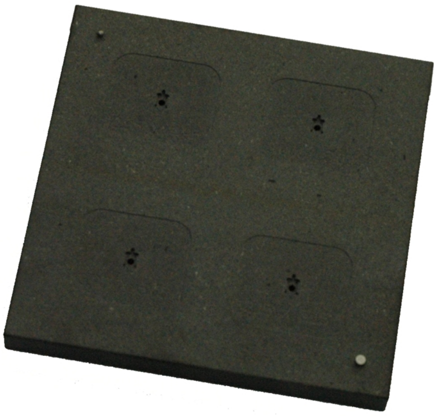
Attenuation values for inductive RF coupler SA-166			
Band	**Channel**	**Attenuation TX (dB)**	**Attenuation RX (dB)**
GSM 850	Low	24,5	19,5
	Mid	24,3	20,5
	High	23,5	18,5
GSM 900	Low	21,2	17,5
	Mid	19,4	17,5
	High	18,8	15,5
GSM 1800	Low	11,4	9,2
	Mid	10,7	9,2
	High	9,0	9,2
GSM 1900	Low	8,0	8,2
	Mid	7,5	8,2
	High	8,6	9,2
WCDMA Band I	Low	9,2	11,1
	Mid	9,1	12,1
	High	10,1	13,1
WCDMA Band VIII	Low	18,7	19,5
	Mid	18,5	19,5
	High	19,5	19,5

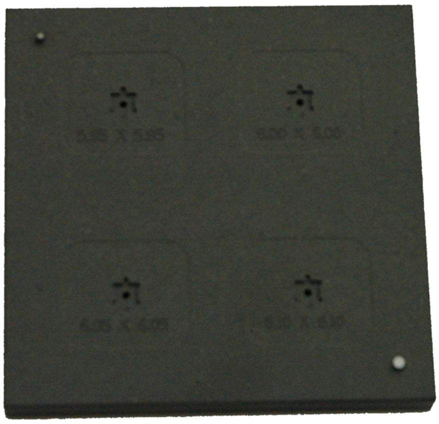
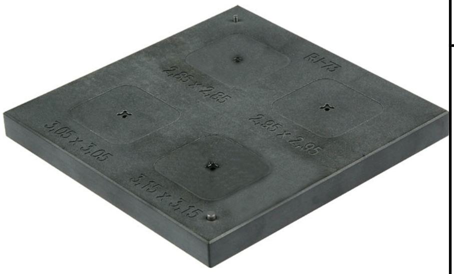
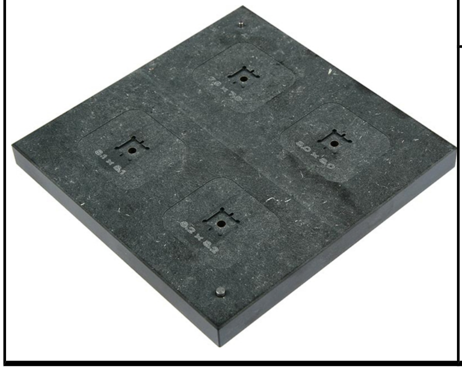
SS-195	Display removal tool	

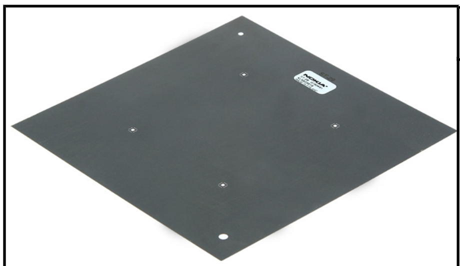
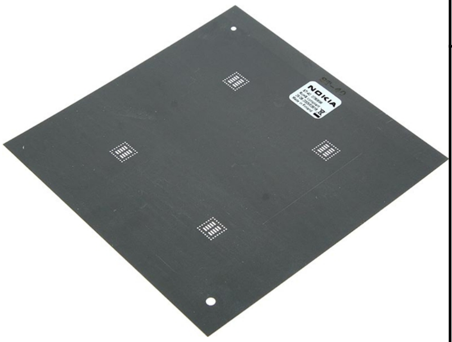
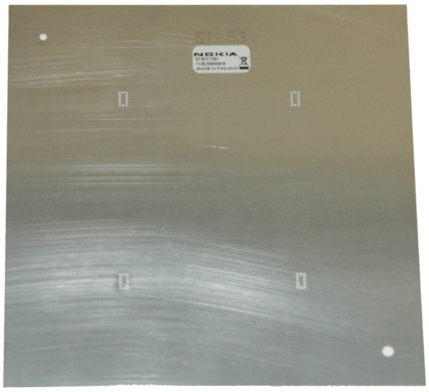
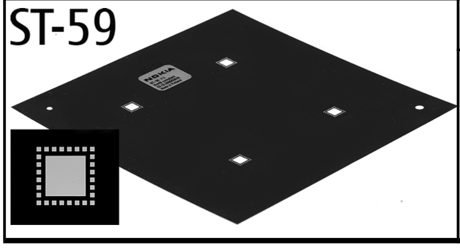
SS-195 is used for removing displays.

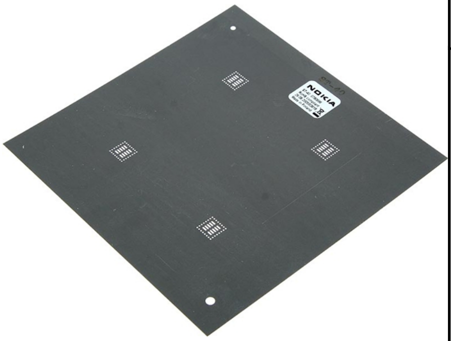
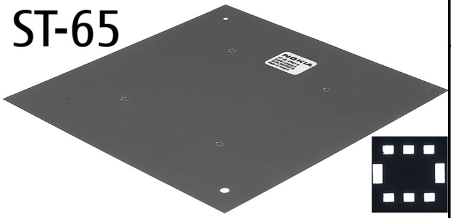
Rework jigs and stencils

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-356. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	RJ-157	Rework jig	
	RJ-157 is a rework jig used when servicing the Z7540 duplexer. It is used together with the ST-55 stencil.		
	RJ-160	Rework jig	
	RJ-160 is a rework jig used when servicing the WCDMA duplexer (Z7541). It is used together with the ST-55 stencil.		
	RJ-166	Rework jig	
	RJ-166 is a jig used when servicing the accelerometer (N6501). It is used together with the ST-53 stencil.		

<table>
<tr><td rowspan="2"></td><td>RJ-169</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-169 is a rework jig used when servicing the WCDMA PA (N7540) component. It is used together with the ST-59 stencil.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-184</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-184 is a rework jig used when servicing the microphone (B2170).
It is used together with the ST-61 rework stencil.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-201</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-201 is a rework jig used when servicing the GSM 850/900 TX filter (Z7503) component.
This jig is used together with the ST-65 stencil.</td></tr>
<tr><td rowspan="2"></td><td>RJ-73</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-73 is a rework jig used when servicing the N1451 component. It is used together with the ST-29 rework stencil.</td></tr>
<tr><td rowspan="2"></td><td>RJ-93</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-93 is used as a rework jig for the Front End Module (FEM).
This rework jig takes the FEM or power amplifier (PA) module (N7520) for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>ST-29</td><td>rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-29 is a rework stencil used when servicing the N1451 component. It is used together with rework jig RJ-73.</td></tr>
<tr><td rowspan="2"></td><td>ST-40</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-40 is a rework stencil that is used with the RJ-93 rework jig to service the Front End Module (N7520).</td></tr>
<tr><td rowspan="2"></td><td>ST-53</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-53 is a rework stencil used when servicing the accelerometer (N6501).
It is used together with the rework jig RJ-166.</td></tr>
<tr><td rowspan="2"> </td><td>ST-55</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-55 is a rework stencil used when servicing the Z7540 and Z7541 duplexers. It is used together with the rework jigs RJ-157 and RJ-160.</td></tr>
<tr><td rowspan="2"> </td><td>ST-59</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-59 is a rework stencil used when servicing the WCDMA PA (N7540) component. It is used together with rework jig RJ-169.</td></tr>
</table>

	ST-61	Rework stencil	
	ST-61 is a rework stencil used when servicing the microphone (B2170). It is used together with the rework jig RJ-184.		
	ST-65	Rework stencil	
	ST-65 is a rework stencil used when servicing the GSM 850/900 TX filter (Z7503). This stencil is used together with the rework jig RJ-201.		

General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-356. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	AC-33	Power supply	
	Universal power supply for FPS-10; included in the FPS-10 sales package.		
	AC-35	Power supply	
	Universal power supply for FPS-21; included in the FPS-21 sales package. Input 100V...230V 50Hz...60Hz, output voltage of 12 V and output current up to 3 A.		

CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

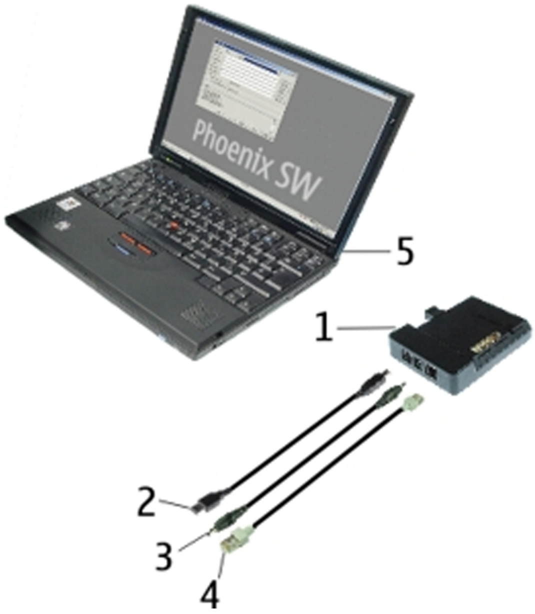
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

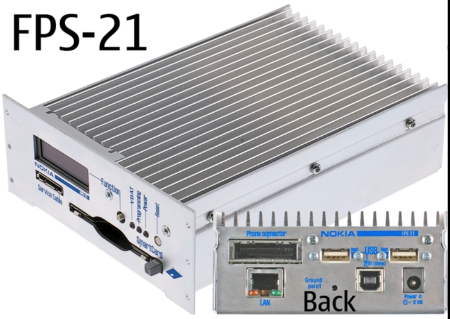
1. Connect a service tool (jig, flash adapter) to CU-4.
2. Connect CU-4 to your PC with a USB cable.
3. Connect supply voltage (12 V)
4. Connect an FBUS cable (if necessary).
5. Start Phoenix service software.



Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2"> </td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.
Note: FLS-5 can be used as an alternative to PKD-1.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable
Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.</td></tr>
</table>



FPS-21	Flash prommer	

FPS-21 sales package:

- FPS-21 prommer
- AC-35 power supply
- CA-31D USB cable

FPS-21 interfaces:

Front

- Service cable connector

  Provides Flashbus, USB and VBAT connections to a mobile device.
- SmartCard socket

  A SmartCard is needed to allow DCT-4 generation mobile device programming.

Rear

- DC power input

  For connecting the external power supply (AC-35).
- Two USB A type ports (USB1/USB3)

  Can be used, for example, for connecting external storage memory devices or mobile devices
- One USB B type device connector (USB2)

  For connecting a PC.
- Phone connector

  Service cable connection for connecting Flashbus/FLA.
- Ethernet RJ45 type socket (LAN)

  For connecting the FPS-21 to LAN.

Inside

- Four SD card memory slots

  For internal storage memory.

> **Note:** In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.
>
> **Note:** FPS-10 can be used for flashing instead of FPS-21 if necessary.

JXS-1	RF shield box	

Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal.

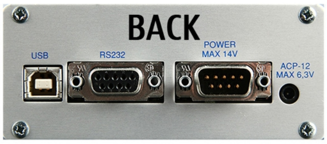
The shield box is not an active device, it contains only passive filtering components for RF attenuation.

<table>
<tr><td rowspan="2">

DESkey
www.des.co.uk

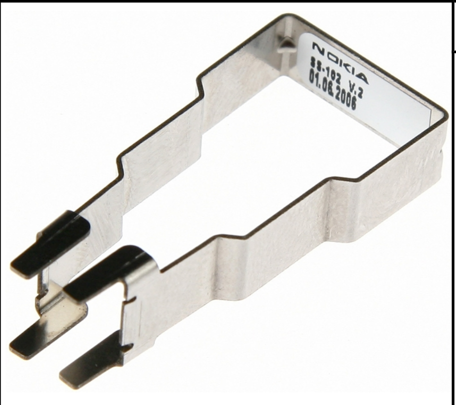
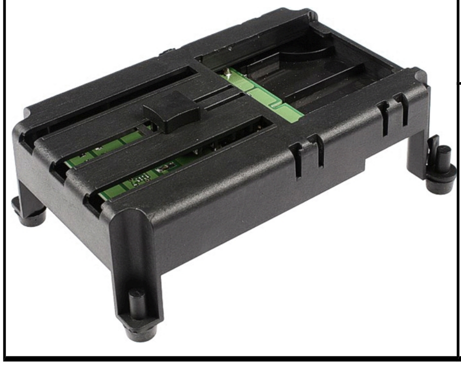
</td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2">

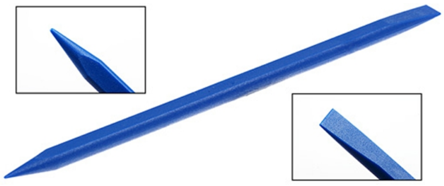
DESkey
www.des.co.uk

</td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2">  </td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
<tr><td rowspan="2">

NOKIA
SPS-1
MADE IN FINLAND

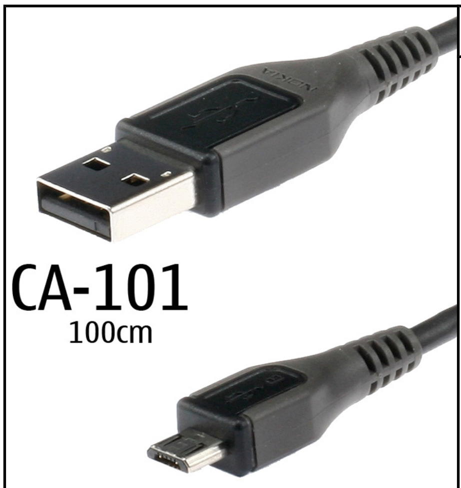
</td><td>SPS-1</td><td>Soldering Paste Spreader</td><td></td></tr>
<tr><td colspan="3">The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>SPS-2</td><td>Soldering paste spreader</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers.</td></tr>
<tr><td rowspan="2"></td><td>SS-102</td><td>Camera removal tool</td><td></td></tr>
<tr><td colspan="3">The camera removal tool SS-102 is used to remove/attach a camera module from/to the camera socket.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
</table>

	SS-93	Opening tool	
	SS-93 is used for opening JAE connectors.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-356. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	CA-101	Micro USB cable	
	The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.		
	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		

CA-35S	Power cable	

CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.

CA-58RS	RF tuning cable	

Product-specific adapter cable for RF tuning.

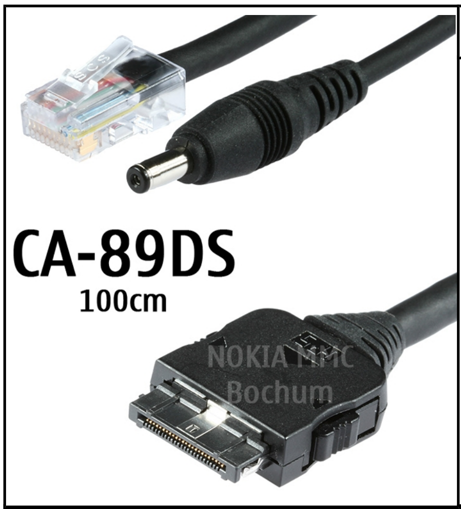
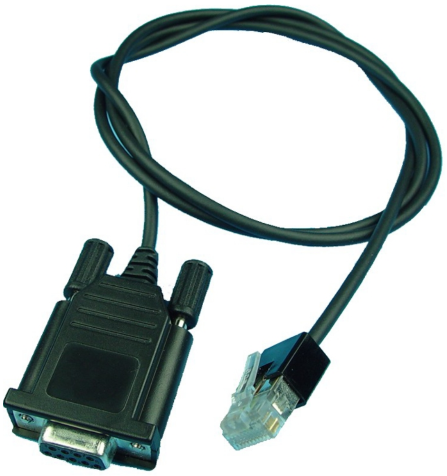
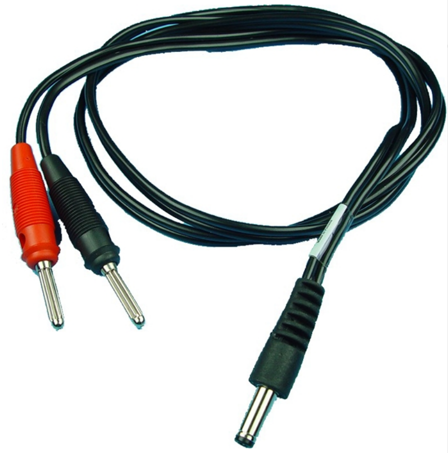
- **Table 8 Attenuation values**

Band	Attenuation Rx/Tx
GSM850/900	0.2...0.3 dB
GSM1800/1900	0.3...0.4 dB
WCDMA900	0.2...0.3 dB
WCDMA2100	0.4...0.6 dB

CA-75U	Video-out cable	

The CA-75U enables viewing video recordings on a TV screen or computer monitor. It can also be used while video conferencing.

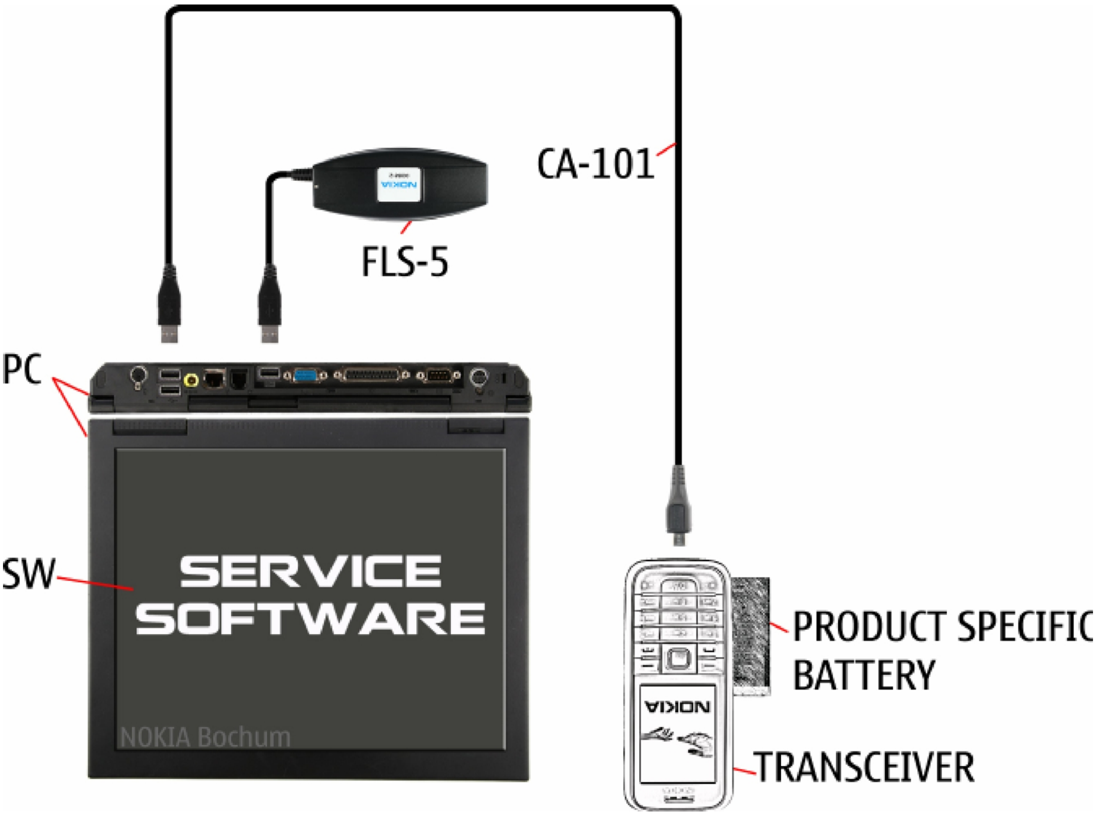
The cable is used to connect the 3.5 mm AV connector of the phone to the RCA connectors of an AV device.

<table>
<tr><td rowspan="2"> </td><td>CA-89DS</td><td>Cable</td><td></td></tr>
<tr><td colspan="3">Provides VBAT and Flashbus connections to mobile device programming adapters.</td></tr>
<tr><td rowspan="2"></td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</td></tr>
<tr><td rowspan="2"></td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WCDMA900: 0.3+-0.1 dB
• WCDMA2100: 0.6+-0.1dB</td></tr>
</table>

Service concepts

POS (Point of Sale) flash concept


CA-101
FLS-5
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Type	Description
Product specific tools	
BL-5J	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	Micro USB cable

Flash concept with FPS-10

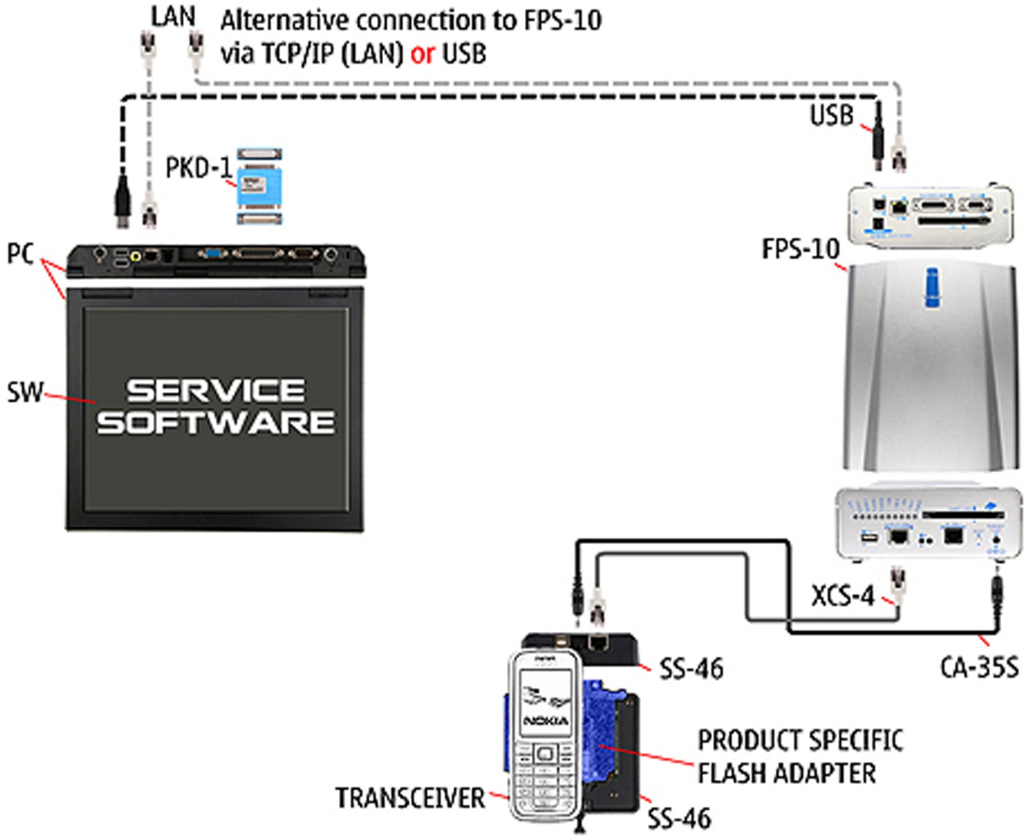

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 2 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-77	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

Flash concept with FPS-21

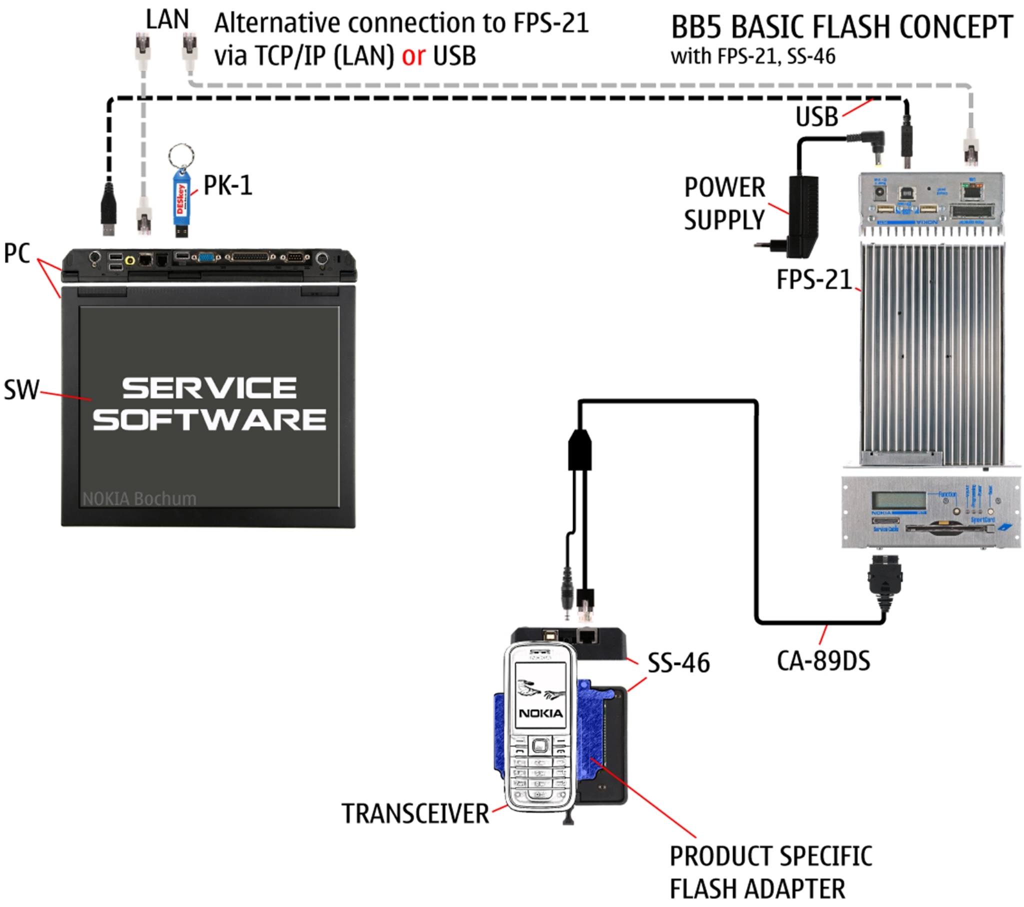

LAN
Alternative connection to FPS-21
via TCP/IP (LAN) or USB
BB5 BASIC FLASH CONCEPT
with FPS-21, SS-46
USB
PK-1
POWER
SUPPLY
PC
FPS-21
SW
SERVICE
SOFTWARE
NOKIA Bochum
SS-46
CA-89DS
TRANSCEIVER
PRODUCT SPECIFIC
FLASH ADAPTER

Figure 3 Basic flash concept with FPS-21

Type	Description
Product specific devices	
FS-77	Flash adapter
Other devices	
FPS-21	Flash prommer box
AC-35	Power supply
PK-1/PKD-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
CA-89DS	Service cable
	USB cable

CU-4 flash concept with FPS-10

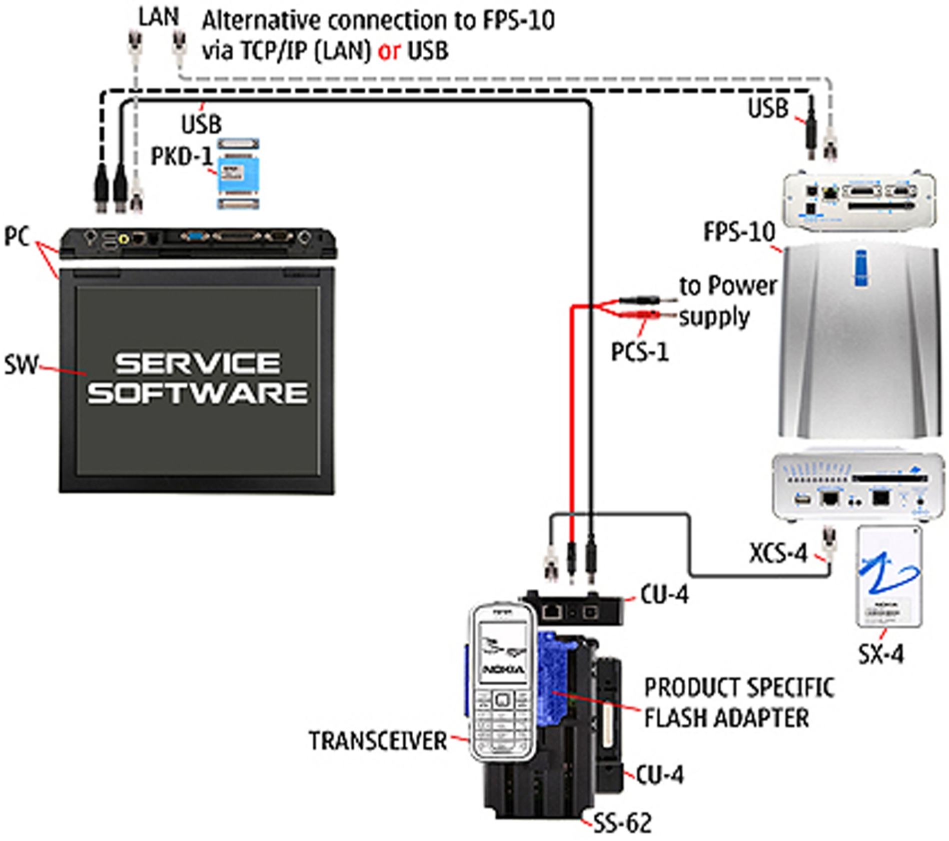

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
PKD-1
PC
SW
SERVICE SOFTWARE
FPS-10
to Power supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-77	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

CU-4 flash concept with FPS-21

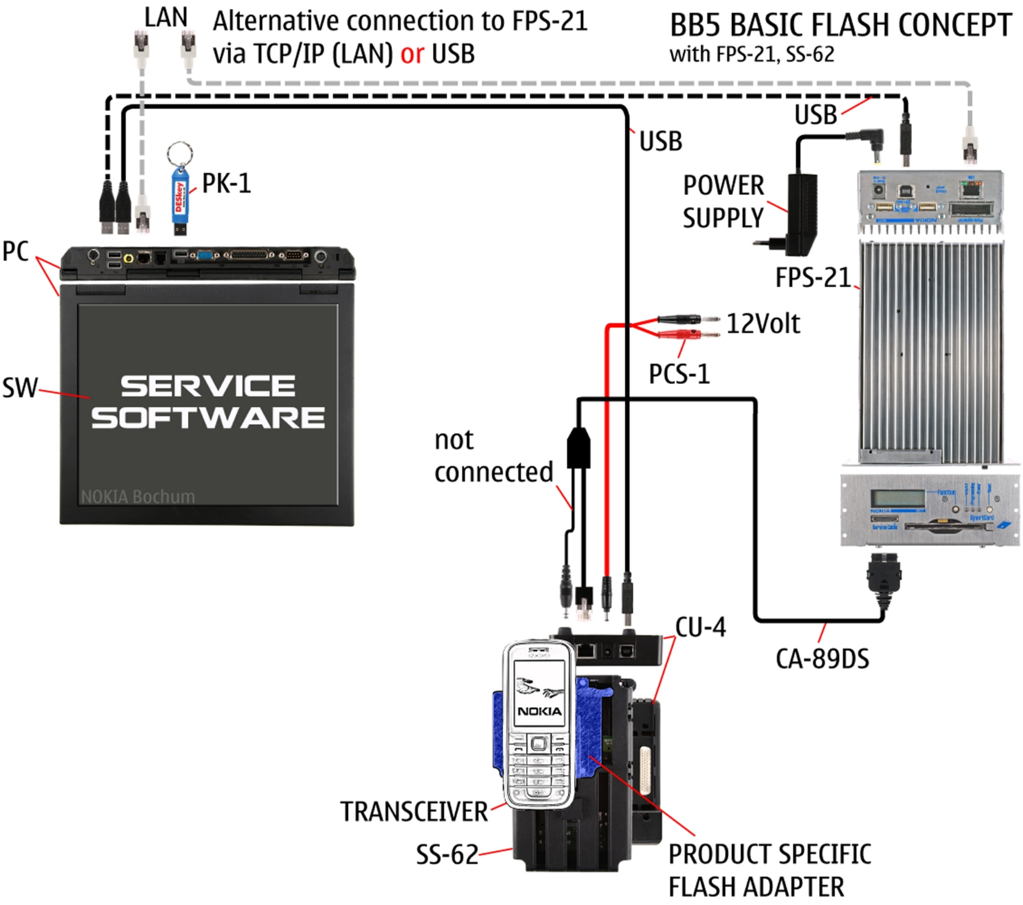

LAN
Alternative connection to FPS-21 via TCP/IP (LAN) or USB
BB5 BASIC FLASH CONCEPT
with FPS-21, SS-62
USB
USB
PK-1
POWER SUPPLY
PC
FPS-21
12Volt
PCS-1
SW
SERVICE SOFTWARE
NOKIA Bochum
not connected
CU-4
CA-89DS
TRANSCEIVER
SS-62
PRODUCT SPECIFIC FLASH ADAPTER

Figure 5 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-77	Flash adapter
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
AC-35	Power supply
PK-1/PKD-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card (for DCT-4 generation mobile device programming)
	PC with Phoenix service software
Cables	
PCS-1	Power cable
CA-89DS	Service cable
	Standard USB cable

Type	Description
	USB cable

Module jig service concept

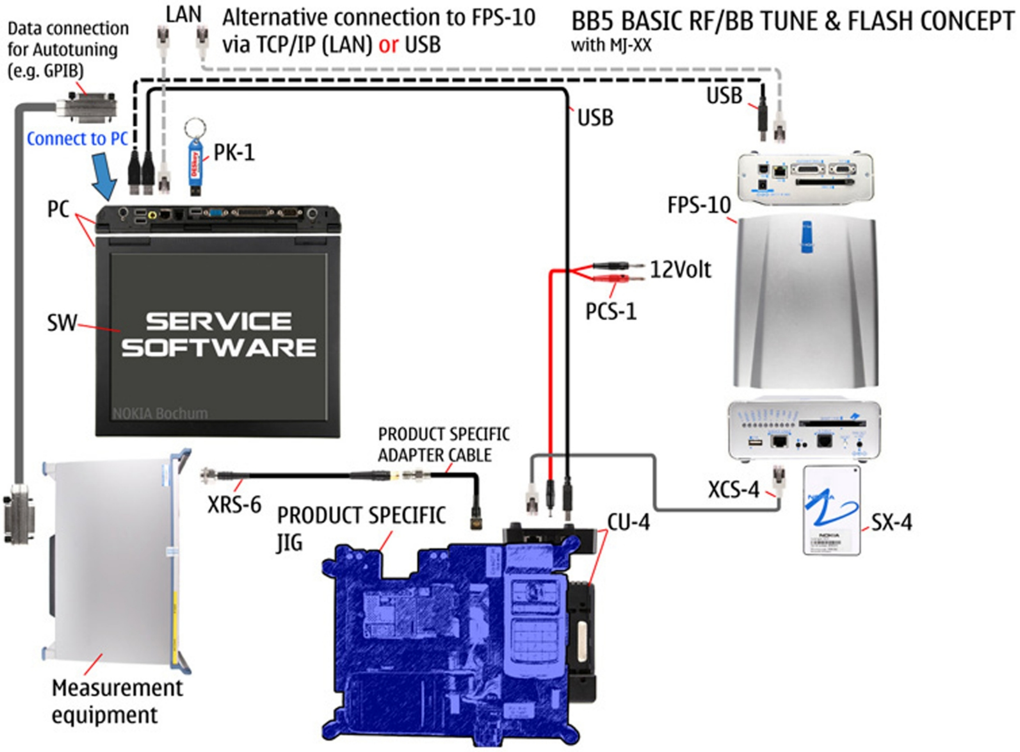

Data connection for Autotuning (e.g. GPIB)
LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
BB5 BASIC RF/BB TUNE & FLASH CONCEPT
with MJ-XX
USB
USB
Connect to PC
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC ADAPTER CABLE
XRS-6
PRODUCT SPECIFIC JIG
CU-4
XCS-4
SX-4
Measurement equipment

Figure 6 Module jig service concept

Type	Description
Phone specific tools	
MJ-165	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
CA-58RS	RF service cable (product-specific adapter cable)
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable

Type	Description
	USB cable
	GPIB control cable

RF testing concept with RF coupler

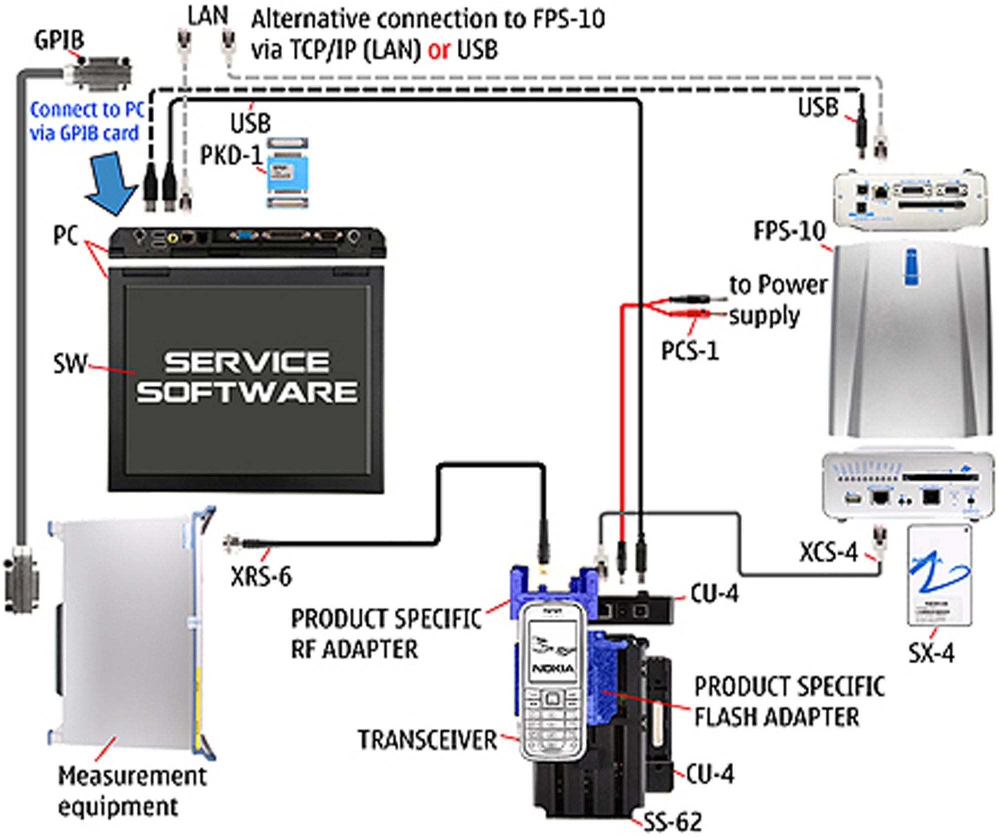

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
GPIB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC
RF ADAPTER
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement
equipment
SS-62

Figure 7 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-77	Flash adapter
SA-166	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	

Type	Description
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

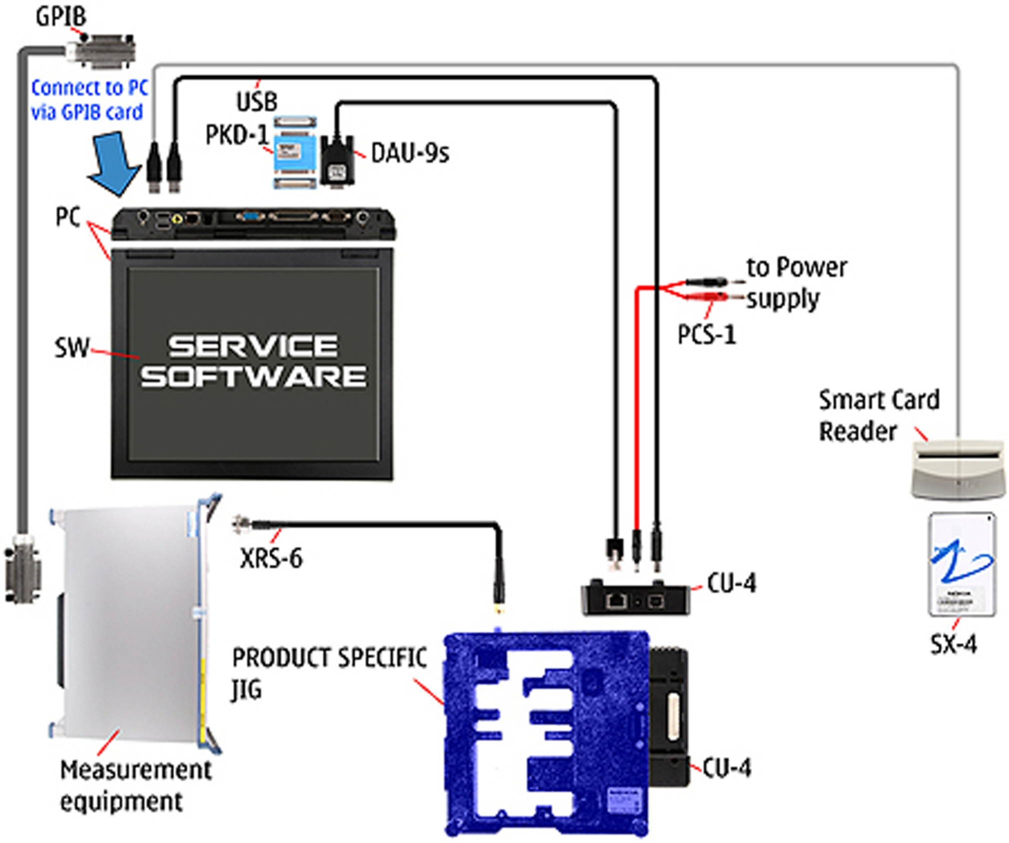

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 8 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-165	Module jig
Other devices	
CU-4	Control unit
PK-1/PKD-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader

Type	Description
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

GPS testing concept with GPS RF coupler

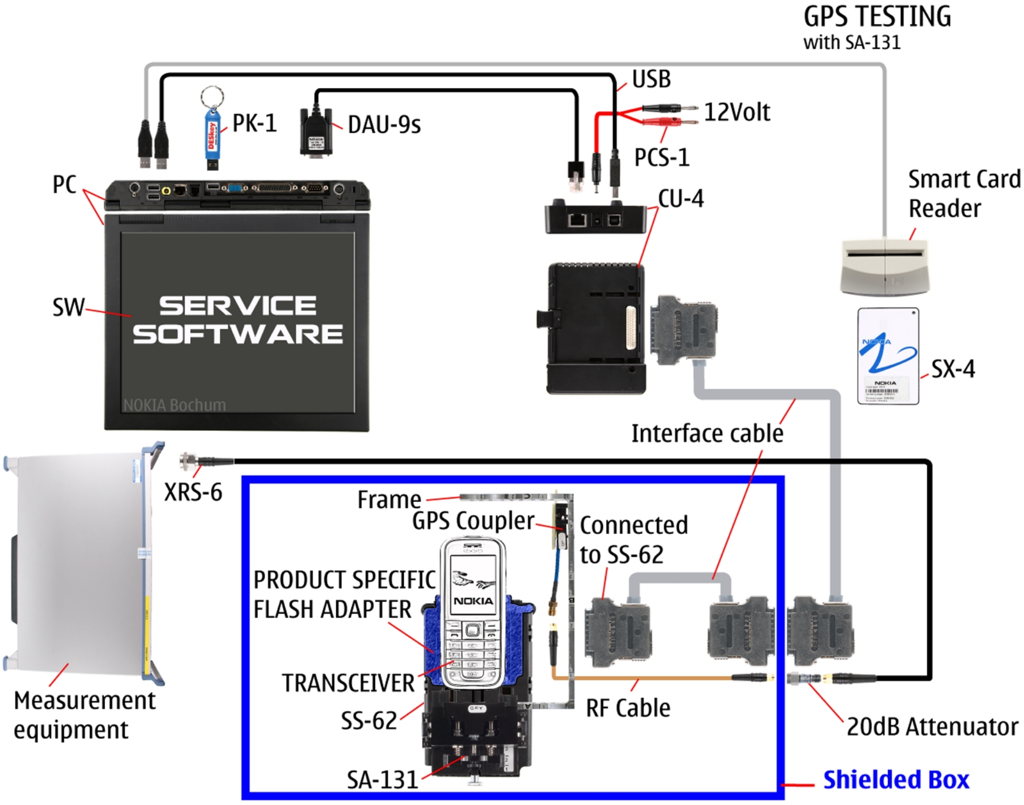

GPS TESTING
with SA-131
USB
PK-1
DAU-9s
12Volt
PCS-1
PC
CU-4
Smart Card
Reader
SW
SERVICE
SOFTWARE
NOKIA Bochum
SX-4
Interface cable
XRS-6
Frame
GPS Coupler
Connected
to SS-62
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-62
SA-131
RF Cable
20dB Attenuator
Measurement
equipment
Shielded Box

Figure 9 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-77	Flash adapter
SA-131	GPS RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
JXS-1	RF shield box

Type	Description
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Smart card reader
	Measurement equipment
	PC with Phoenix service software
Cables	
CA-58RS	RF service cable (product-specific adapter cable)
PCS-1	Power cable
DAU-9S	MBUS cable
XRS-6	RF cable
	20dB attenuator
	Interface cable
	USB cable

Bluetooth testing concept with SB-6

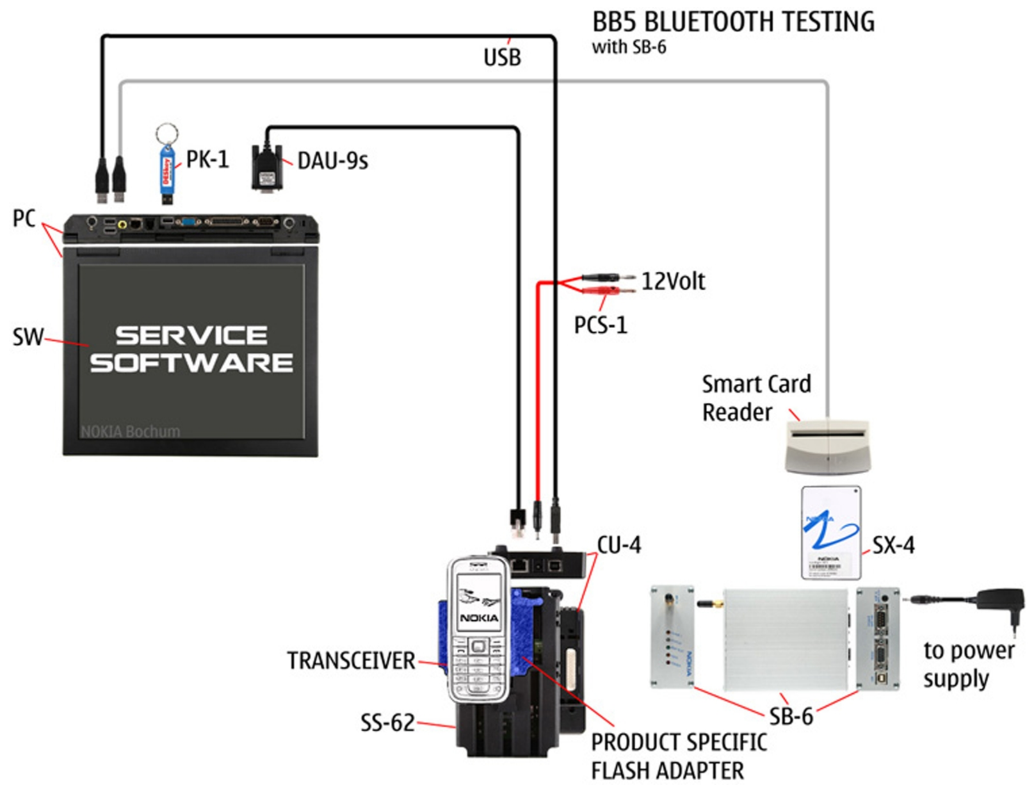

BB5 BLUETOOTH TESTING
with SB-6
USB
PK-1
DAU-9s
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
12Volt
PCS-1
Smart Card Reader
CU-4
SX-4
to power supply
TRANSCEIVER
SS-62
SB-6
PRODUCT SPECIFIC FLASH ADAPTER

Figure 10 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
FS-77	Flash adapter

Type	Description
Other devices	
CU-4	Control unit
SS-62	Flash adapter base
PK-1	SW security device
SX-4	Smart card
SB-6	Bluetooth test and interface box
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
	USB cable

WLAN functionality testing concept with SB-7

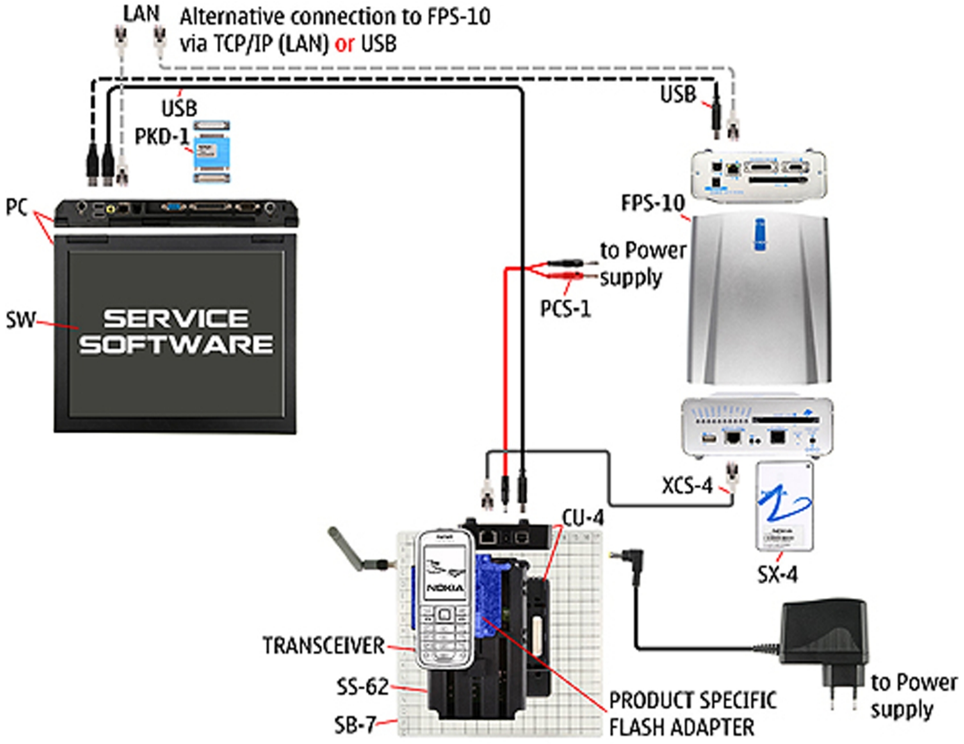

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
PKD-1
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XCS-4
CU-4
SX-4
TRANSCEIVER
SS-62
SB-7
PRODUCT SPECIFIC
FLASH ADAPTER
to Power
supply

Figure 11 WLAN functionality testing concept with SB-7

Type	Description
Product specific tools	
FS-77	Flash adapter
Other tools	
CU-4	Control unit

Type	Description
PCS-1	DC power cable
PK-1	SW Security device
SS-62	Generic base adapter
Cables	
PCS-1	Power cable
DAU-9S	Cable
	Standard USB cable

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3 — BB Troubleshooting and Manual Tuning Guide

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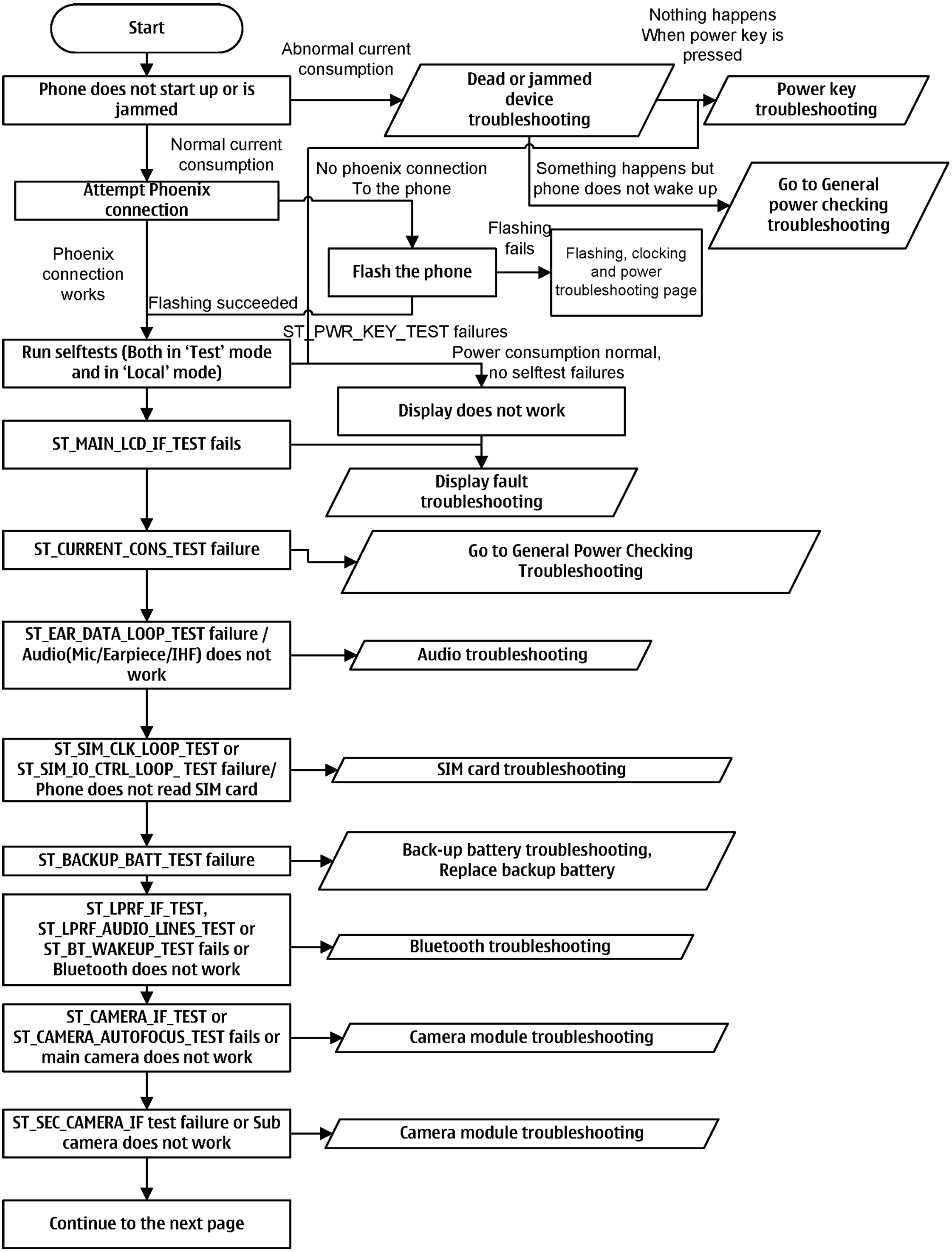
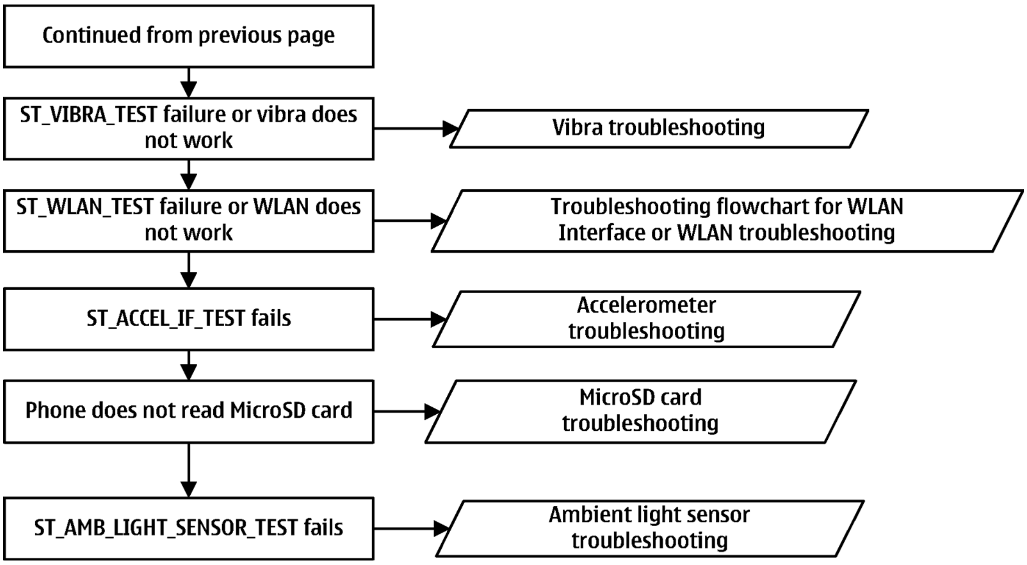
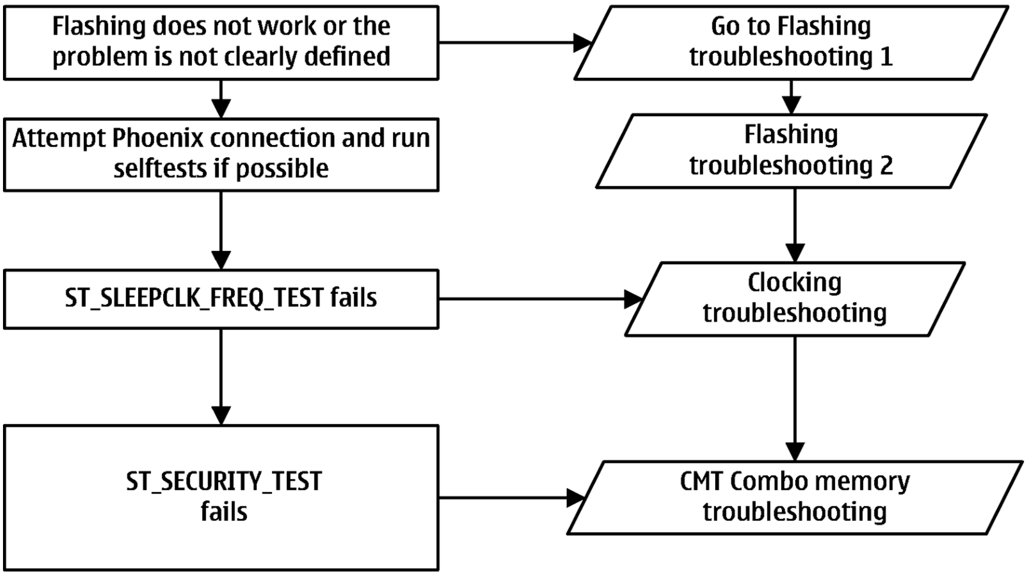
Baseband main troubleshooting

Troubleshooting flow


Start
Phone does not start up or is jammed
Abnormal current consumption
Dead or jammed device troubleshooting
Nothing happens When power key is pressed
Power key troubleshooting
Normal current consumption
Attempt Phoenix connection
No phoenix connection To the phone
Something happens but phone does not wake up
Go to General power checking troubleshooting
Flash the phone
Flashing fails
Flashing, clocking and power troubleshooting page
Phoenix connection works
Flashing succeeded
ST_PWR_KEY_TEST failures
Run selftests (Both in 'Test' mode and in 'Local' mode)
Power consumption normal, no selftest failures
Display does not work
ST_MAIN_LCD_IF_TEST fails
Display fault troubleshooting
ST_CURRENT_CONS_TEST failure
Go to General Power Checking Troubleshooting
ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work
Audio troubleshooting
ST_SIM_CLK_LOOP_TEST or ST_SIM_IO_CTRL_LOOP_ TEST failure/ Phone does not read SIM card
SIM card troubleshooting
ST_BACKUP_BATT_TEST failure
Back-up battery troubleshooting, Replace backup battery
ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST or ST_BT_WAKEUP_TEST fails or Bluetooth does not work
Bluetooth troubleshooting
ST_CAMERA_IF_TEST or ST_CAMERA_AUTOFOCUS_TEST fails or main camera does not work
Camera module troubleshooting
ST_SEC_CAMERA_IF test failure or Sub camera does not work
Camera module troubleshooting
Continue to the next page

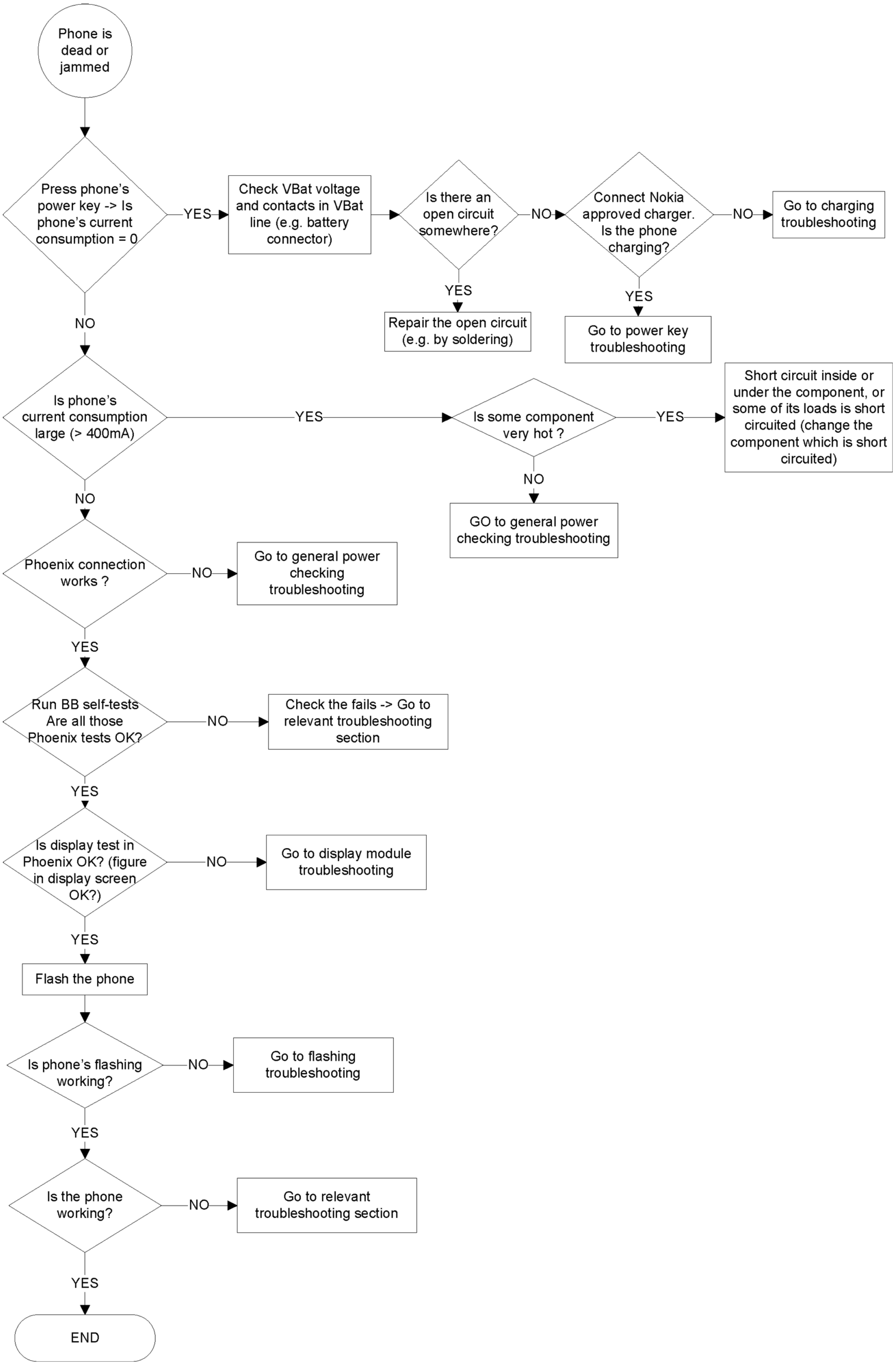

Continued from previous page
ST_VIBRA_TEST failure or vibra does not work
Vibra troubleshooting
ST_WLAN_TEST failure or WLAN does not work
Troubleshooting flowchart for WLAN Interface or WLAN troubleshooting
ST_ACCEL_IF_TEST fails
Accelerometer troubleshooting
Phone does not read MicroSD card
MicroSD card troubleshooting
ST_AMB_LIGHT_SENSOR_TEST fails
Ambient light sensor troubleshooting

Flashing, clocking and power troubleshooting


Flashing does not work or the problem is not clearly defined
Go to Flashing troubleshooting 1
Attempt Phoenix connection and run selftests if possible
Flashing troubleshooting 2
ST_SLEEPCLK_FREQ_TEST fails
Clocking troubleshooting
ST_SECURITY_TEST fails
CMT Combo memory troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check VBat voltage and contacts in VBat line (e.g. battery connector)
Is there an open circuit somewhere?
NO
Connect Nokia approved charger. Is the phone charging?
NO
Go to charging troubleshooting
YES
Repair the open circuit (e.g. by soldering)
YES
Go to power key troubleshooting
NO
Is phone's current consumption large (> 400mA)
YES
Is some component very hot ?
YES
Short circuit inside or under the component, or some of its loads is short circuited (change the component which is short circuited)
NO
GO to general power checking troubleshooting
NO
Phoenix connection works ?
NO
Go to general power checking troubleshooting
YES
Run BB self-tests Are all those Phoenix tests OK?
NO
Check the fails -> Go to relevant troubleshooting section
YES
Is display test in Phoenix OK? (figure in display screen OK?)
NO
Go to display module troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to flashing troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
END

General power checking

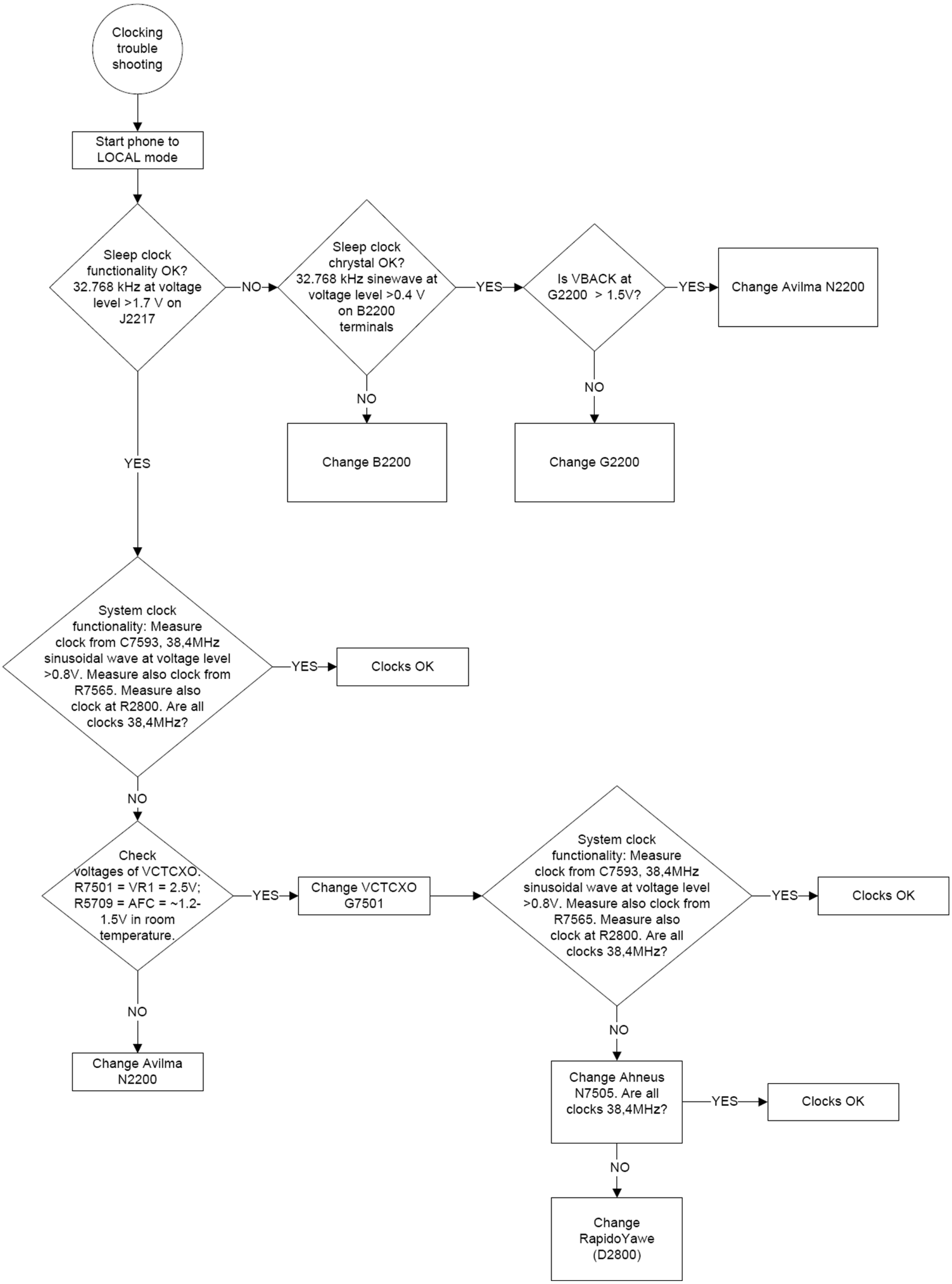
General power checking

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIO_V	AVILMA	ON	ON	1.82	Vilma I/O		VBAT1
VBACK	AVILMA	ON	ON	2.5	RTC circuitry		
VSIM1	AVILMA	ON	ON	1.8/3,0	SIM card		VBAT3
VSIM2	AVILMA	ON	ON	3,0	Digital microphone		VBAT3
VAUX	AVILMA	ON	ON	2.78	Accelerometer, proximity sensor, TV out driver, display		VBAT5
VANA	AVILMA	ON	ON	2.5	Vilma internal		VBAT4
VR1	AVILMA	OFF	ON	2.5	VCTCXO		VBAT4
VRFC	AVILMA	OFF	OFF	1.8	RAPIDO converter		
VRCP1	AVILMA	OFF	OFF	4.75	RF module	RF active	VBATCP
VOUT	BETTY	ON	ON	2,5	ALS, audio switch		VBAT6
VDAC	LP3985			3,0	DAC33	On when used	VBAT
VCAM_1V8	LM3677	OFF	OFF	1,8	Camera HWA , LP5952, cameras, flashlight driver		VBAT
VCAM_1V3	LP5952	OFF	OFF	1,3	Camera HWA core		LM3677
VCAM_2V8	BH28SA2	OFF	OFF	2,8	Cameras		VBAT
VCORE	TPS62350	ON	ON	1,2	Rapido core		VBAT
VIO	LM3677	ON	ON	1.8	VIO, VDRAM		VBAT
VSD	SD levelsifter	OFF	OFF	2,9	SD card	ON when used	VBAT
LEDOUT	TK65604	OFF			Display backlights		VBAT
LED B,G,R	LP5521	OFF			Keyboard backlights		VBAT

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VLED_XPRESS	TPS75105	OFF			Media key backlight		VBAT
	ADP1653	OFF	OFF	4,5/5,5	Camera flash		VBAT
VBAT				3,6			

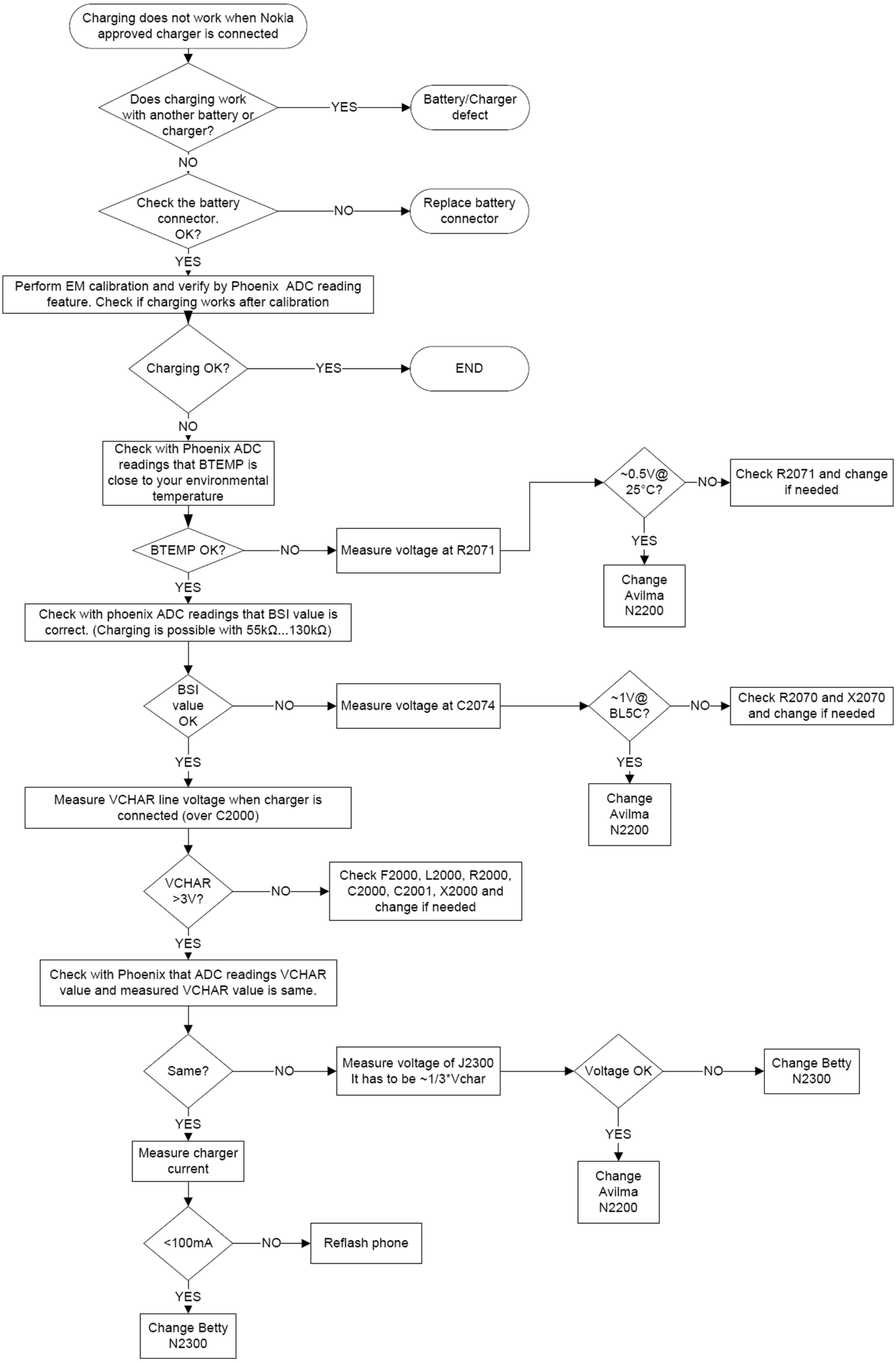
Clocking troubleshooting

Troubleshooting flow


Clocking trouble shooting
Start phone to LOCAL mode
Sleep clock functionality OK? 32.768 kHz at voltage level >1.7 V on J2217
NO
Sleep clock chrystal OK? 32.768 kHz sinewave at voltage level >0.4 V on B2200 terminals
YES
Is VBACK at G2200 > 1.5V?
YES
Change Avilma N2200
NO
Change B2200
NO
Change G2200
YES
System clock functionality: Measure clock from C7593, 38,4MHz sinusoidal wave at voltage level >0.8V. Measure also clock from R7565. Measure also clock at R2800. Are all clocks 38,4MHz?
YES
Clocks OK
NO
Check voltages of VCTCXO. R7501 = VR1 = 2.5V; R5709 = AFC = ~1.2-1.5V in room temperature.
YES
Change VCTCXO G7501
System clock functionality: Measure clock from C7593, 38,4MHz sinusoidal wave at voltage level >0.8V. Measure also clock from R7565. Measure also clock at R2800. Are all clocks 38,4MHz?
YES
Clocks OK
NO
Change Avilma N2200
NO
Change Ahneus N7505. Are all clocks 38,4MHz?
YES
Clocks OK
NO
Change RapidoYawe (D2800)

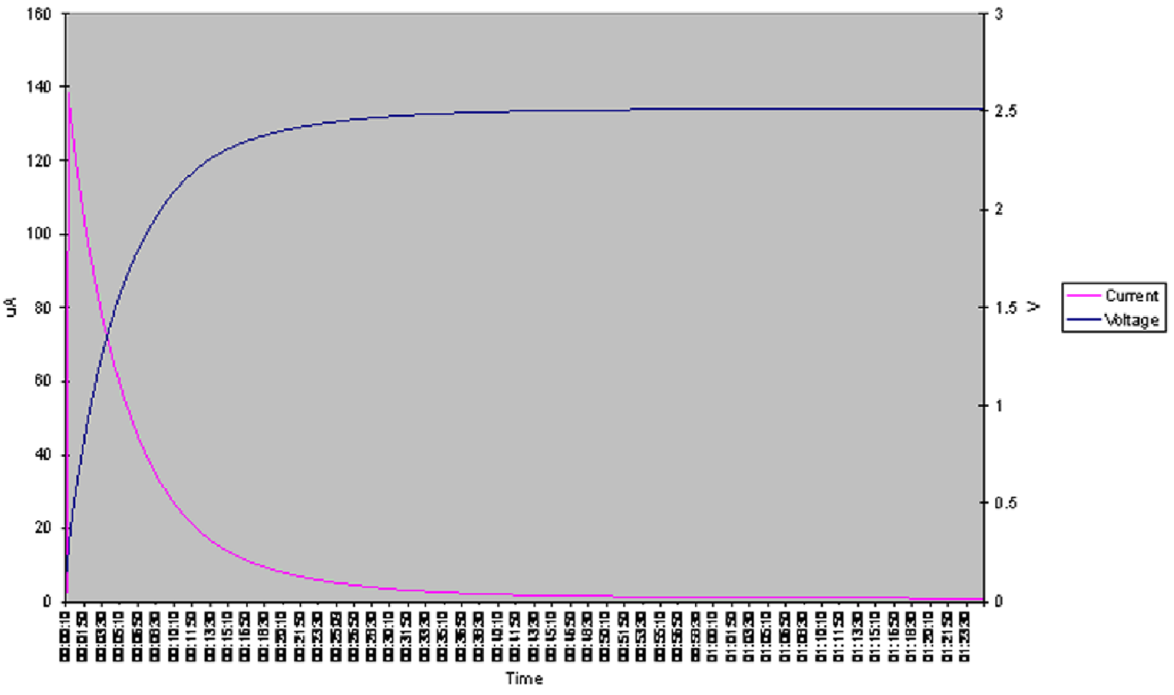
Charging troubleshooting

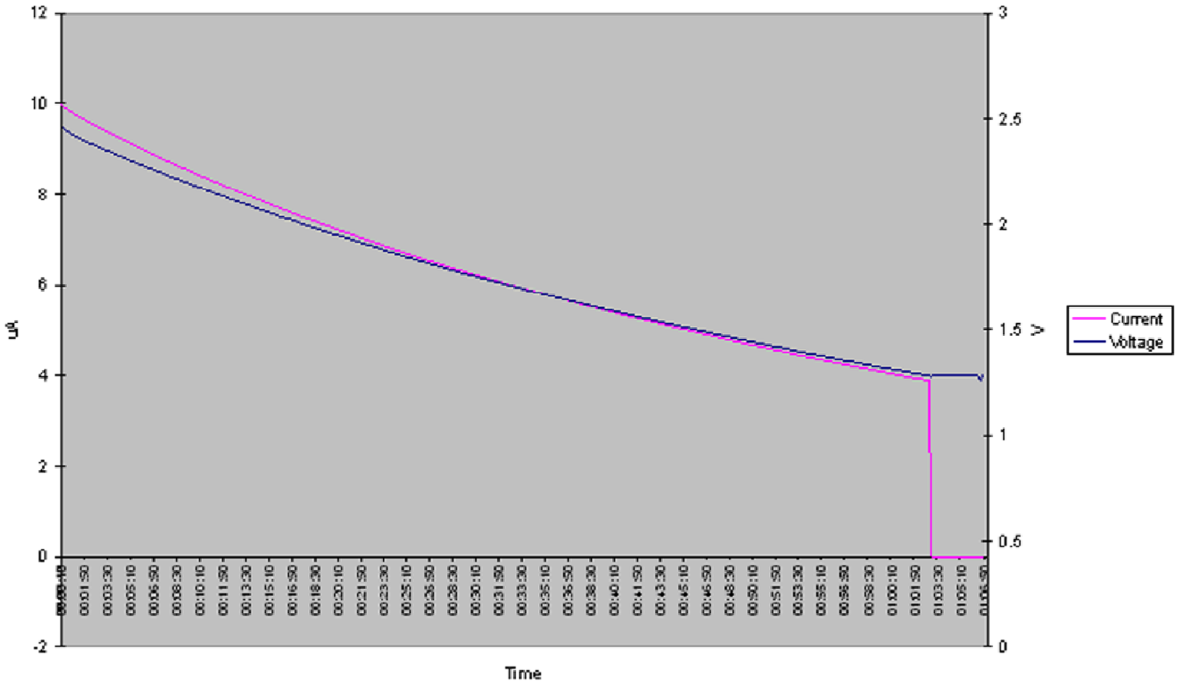
Troubleshooting flow


Charging does not work when Nokia approved charger is connected
Does charging work with another battery or charger?
YES
Battery/Charger defect
NO
Check the battery connector. OK?
NO
Replace battery connector
YES
Perform EM calibration and verify by Phoenix ADC reading feature. Check if charging works after calibration
Charging OK?
YES
END
NO
Check with Phoenix ADC readings that BTEMP is close to your environmental temperature
BTEMP OK?
NO
Measure voltage at R2071
~0.5V@ 25°C?
NO
Check R2071 and change if needed
YES
Change Avilma N2200
YES
Check with phoenix ADC readings that BSI value is correct. (Charging is possible with 55kΩ...130kΩ)
BSI value OK
NO
Measure voltage at C2074
~1V@ BL5C?
NO
Check R2070 and X2070 and change if needed
YES
Change Avilma N2200
YES
Measure VCHAR line voltage when charger is connected (over C2000)
VCHAR >3V?
NO
Check F2000, L2000, R2000, C2000, C2001, X2000 and change if needed
YES
Check with Phoenix that ADC readings VCHAR value and measured VCHAR value is same.
Same?
NO
Measure voltage of J2300 It has to be ~1/3*Vchar
Voltage OK
NO
Change Betty N2300
YES
Change Avilma N2200
YES
Measure charger current
<100mA
NO
Reflash phone
YES
Change Betty N2300

Backup battery troubleshooting

Verify that the backup battery G2200 is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on. Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below:

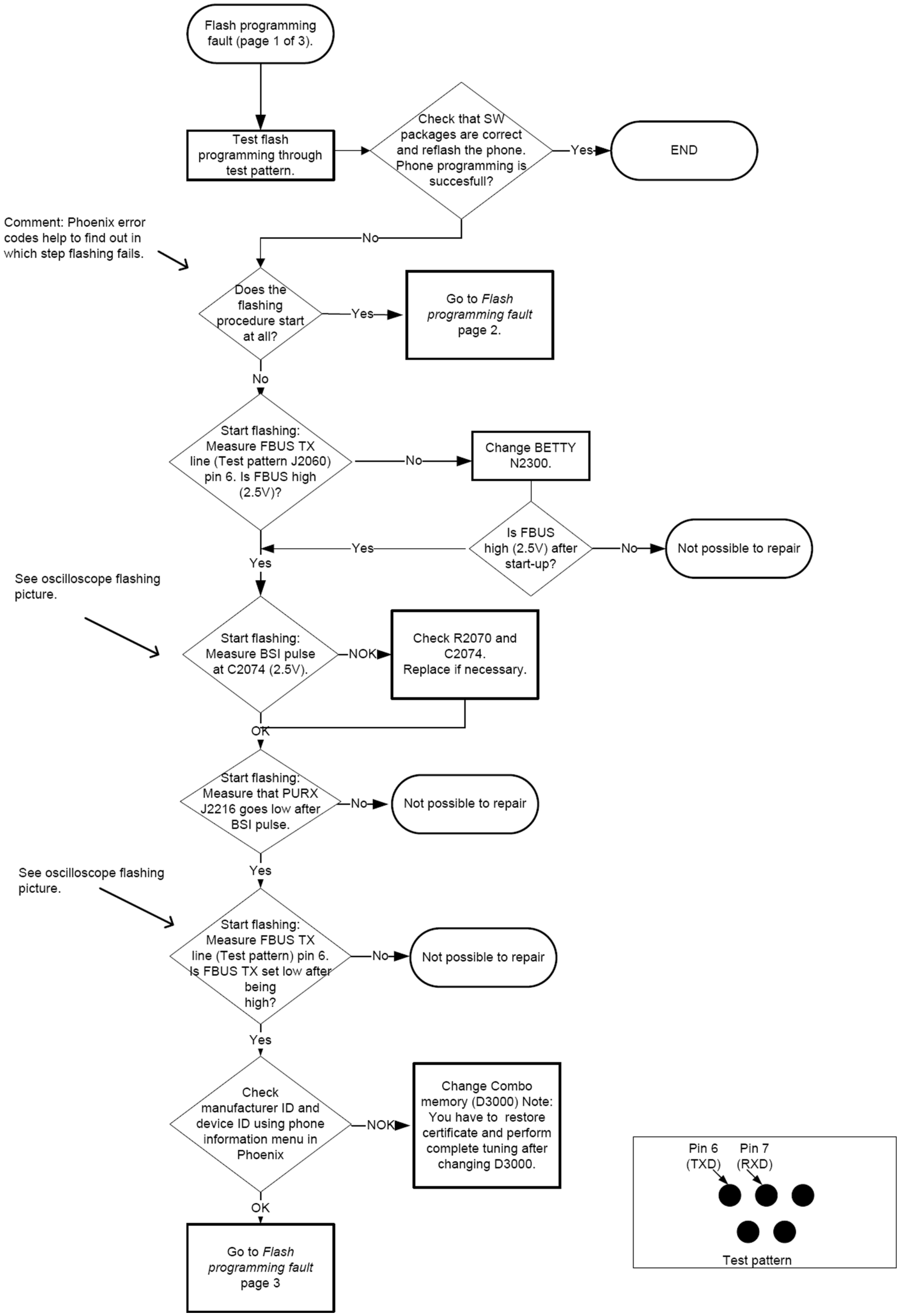


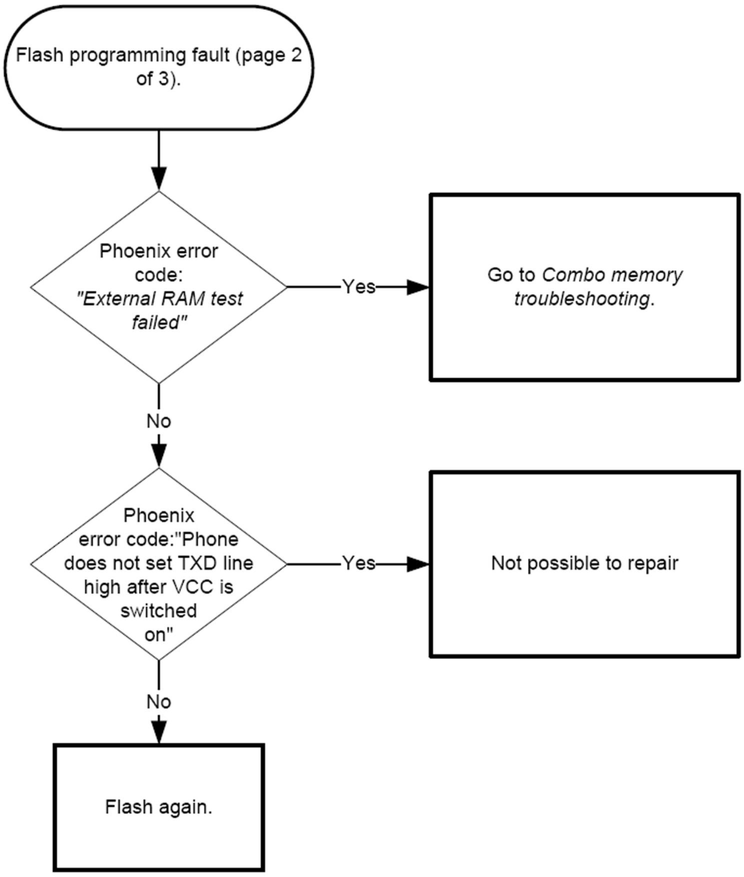


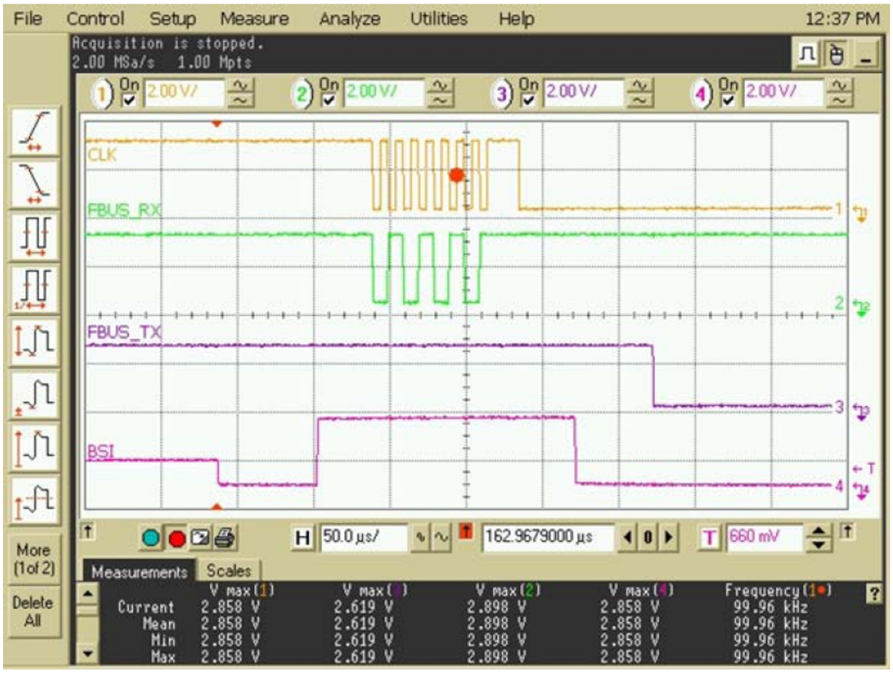
If the voltage rises and falls quickly, check the back-up battery G2200 contacts for loose soldering or short-circuit, and repair or change G2200 if necessary. If the voltage stays ~0V, check resistance VBACK against GND. If there is no shortcircuit, AVILMA N2200 is faulty. Replace N2200.

Flash programming troubleshooting

Troubleshooting flow

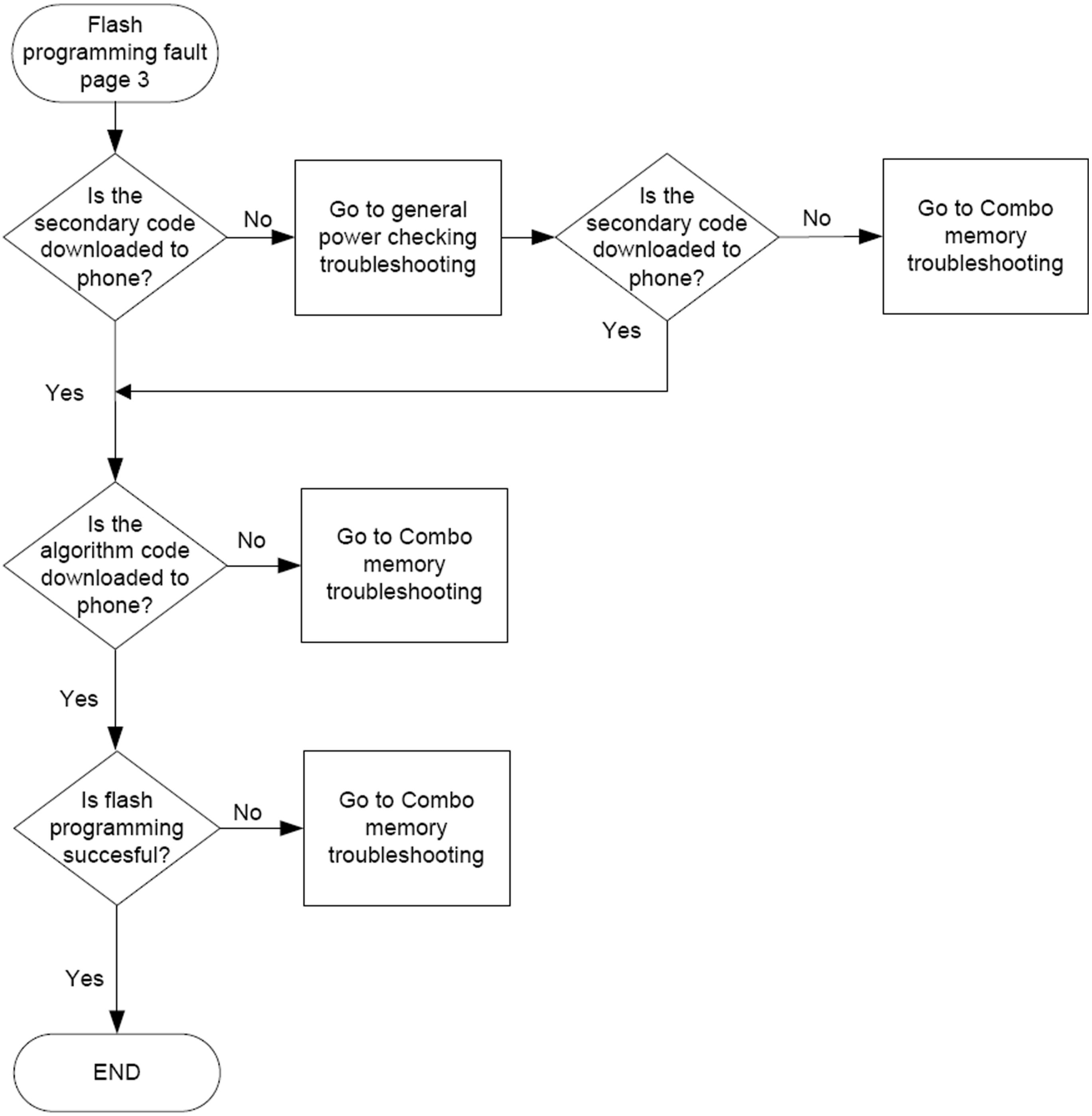

Flash programming fault (page 1 of 3).
Test flash programming through test pattern.
Check that SW packages are correct and reflash the phone. Phone programming is succesfull?
Yes
END
No
Comment: Phoenix error codes help to find out in which step flashing fails.
Does the flashing procedure start at all?
Yes
Go to *Flash programming fault* page 2.
No
Start flashing: Measure FBUS TX line (Test pattern J2060) pin 6. Is FBUS high (2.5V)?
No
Change BETTY N2300.
Is FBUS high (2.5V) after start-up?
No
Not possible to repair
Yes
Yes
See oscilloscope flashing picture.
Start flashing: Measure BSI pulse at C2074 (2.5V).
NOK
Check R2070 and C2074. Replace if necessary.
OK
Start flashing: Measure that PURX J2216 goes low after BSI pulse.
No
Not possible to repair
Yes
See oscilloscope flashing picture.
Start flashing: Measure FBUS TX line (Test pattern) pin 6. Is FBUS TX set low after being high?
No
Not possible to repair
Yes
Check manufacturer ID and device ID using phone information menu in Phoenix
NOK
Change Combo memory (D3000) Note: You have to restore certificate and perform complete tuning after changing D3000.
OK
Go to *Flash programming fault* page 3
Pin 6 (TXD)
Pin 7 (RXD)
Test pattern


Flash programming fault (page 2 of 3).
Phoenix error code: *"External RAM test failed"*
Yes
Go to *Combo memory troubleshooting.*
No
Phoenix error code:"Phone does not set TXD line high after VCC is switched on"
Yes
Not possible to repair
No
Flash again.


File
Control
Setup
Measure
Analyze
Utilities
Help
12:37 PM
1 On 2.00 V/
2 On 2.00 V/
3 On 2.00 V/
4 On 2.00 V/
CLK
FBUS_RX
FBUS_TX
BSI
1
2
3
4
T
H 50.0 µs/
162.9679000 µs
0
T 660 mV
More (1of 2)
Delete All
Measurements
Scales

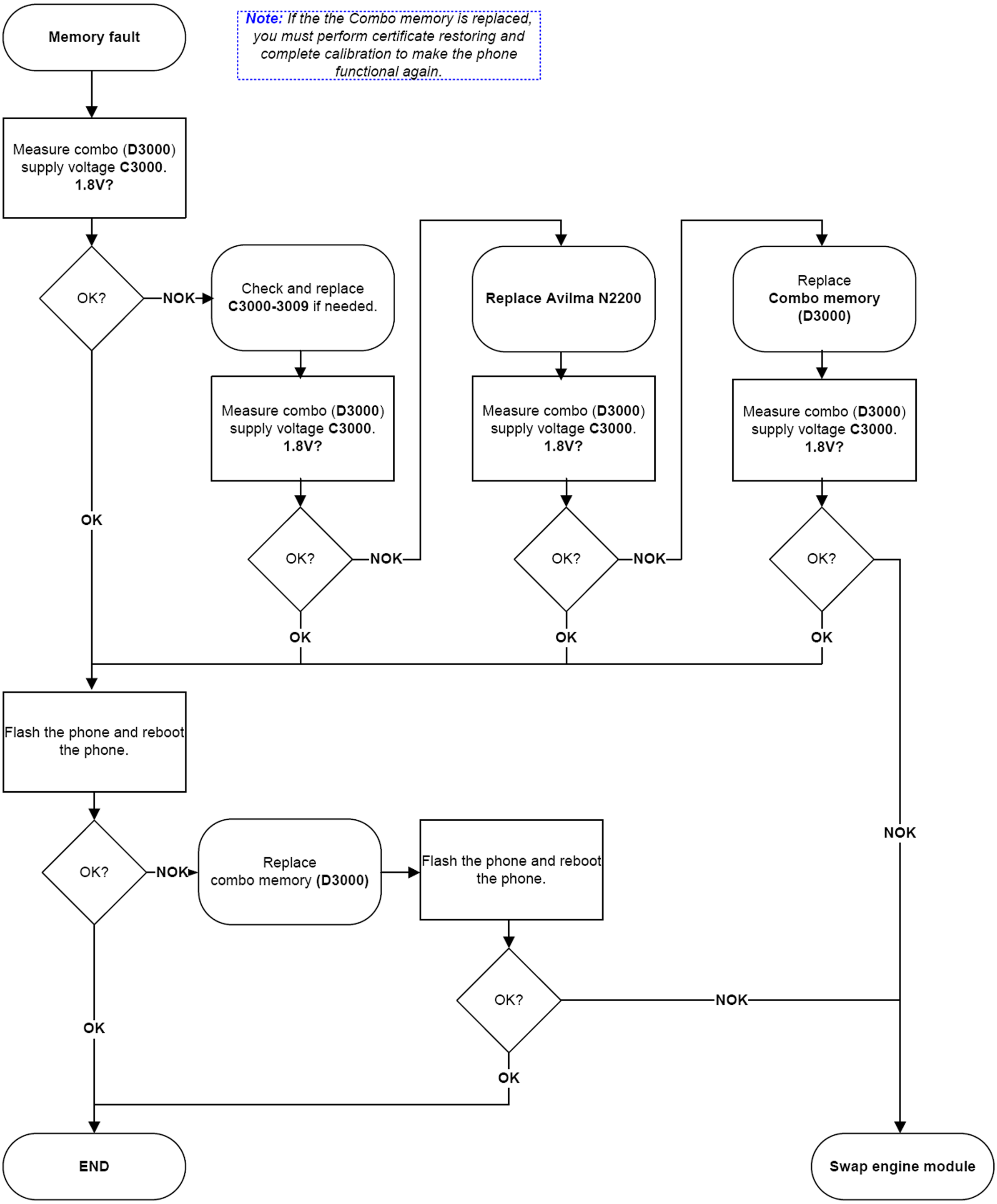
```
Acquisition is stopped.
2.00 MSa/s   1.00 Mpts
```

```
             V max(1)     V max(3)     V max(2)     V max(4)     Frequency(1)
  Current    2.858 V      2.619 V      2.898 V      2.858 V      99.96 kHz
     Mean    2.858 V      2.619 V      2.898 V      2.858 V      99.96 kHz
      Min    2.858 V      2.619 V      2.898 V      2.858 V      99.96 kHz
      Max    2.858 V      2.619 V      2.898 V      2.858 V      99.96 kHz
```


Flash programming fault page 3
Is the secondary code downloaded to phone?
No
Go to general power checking troubleshooting
Is the secondary code downloaded to phone?
No
Go to Combo memory troubleshooting
Yes
Yes
Is the algorithm code downloaded to phone?
No
Go to Combo memory troubleshooting
Yes
Is flash programming succesful?
No
Go to Combo memory troubleshooting
Yes
END

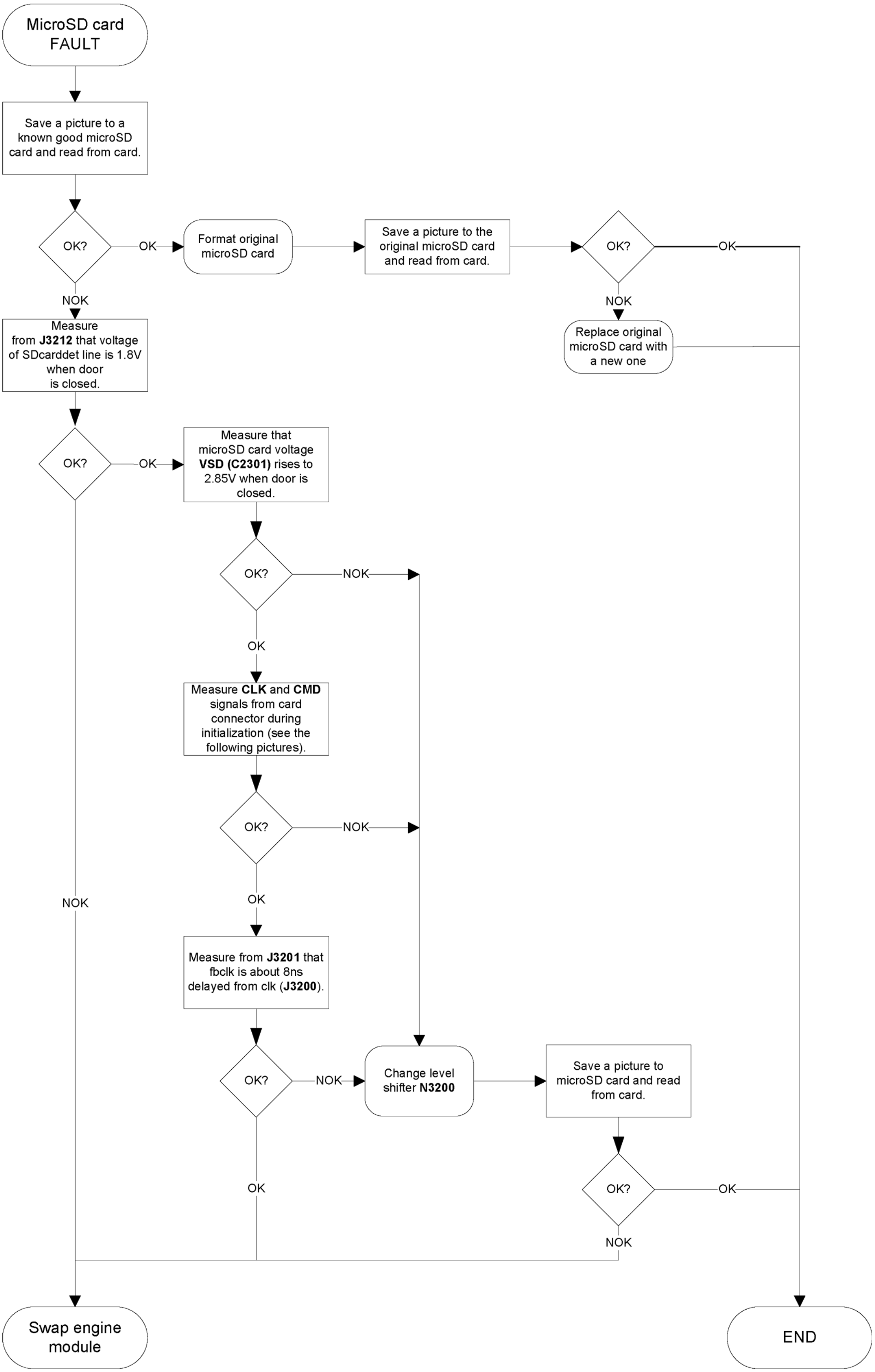
Combo memory troubleshooting

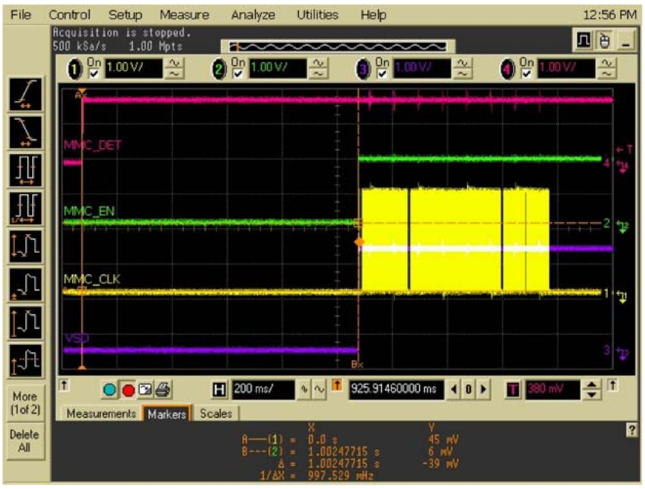
Troubleshooting flow


Memory fault
Note: If the the Combo memory is replaced, you must perform certificate restoring and complete calibration to make the phone functional again.
Measure combo (D3000) supply voltage C3000. 1.8V?
OK?
NOK
Check and replace C3000-3009 if needed.
Measure combo (D3000) supply voltage C3000. 1.8V?
OK?
NOK
Replace Avilma N2200
Measure combo (D3000) supply voltage C3000. 1.8V?
OK?
NOK
Replace Combo memory (D3000)
Measure combo (D3000) supply voltage C3000. 1.8V?
OK?
OK
OK
OK
OK
Flash the phone and reboot the phone.
OK?
NOK
Replace combo memory (D3000)
Flash the phone and reboot the phone.
OK?
NOK
NOK
OK
OK
END
Swap engine module

MicroSD card troubleshooting

Troubleshooting flow

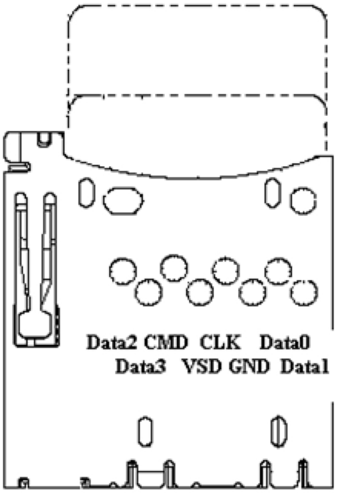

MicroSD card FAULT
Save a picture to a known good microSD card and read from card.
OK?
OK
Format original microSD card
Save a picture to the original microSD card and read from card.
OK?
OK
NOK
Replace original microSD card with a new one
NOK
Measure from **J3212** that voltage of SDcarddet line is 1.8V when door is closed.
OK?
OK
Measure that microSD card voltage **VSD (C2301)** rises to 2.85V when door is closed.
OK?
NOK
OK
Measure **CLK** and **CMD** signals from card connector during initialization (see the following pictures).
OK?
NOK
OK
Measure from **J3201** that fbclk is about 8ns delayed from clk (**J3200**).
NOK
OK?
NOK
Change level shifter **N3200**
Save a picture to microSD card and read from card.
OK?
OK
OK
NOK
Swap engine module
END


File Control Setup Measure Analyze Utilities Help 12:56 PM
1 On 1.00 V/
2 On 1.00 V/
3 On 1.00 V/
4 On 1.00 V/
MMC_DET
MMC_EN
MMC_CLK
VSD
H 200 ms/
925.91460000 ms
T 380 mV
Measurements Markers Scales
More (1 of 2)
Delete All

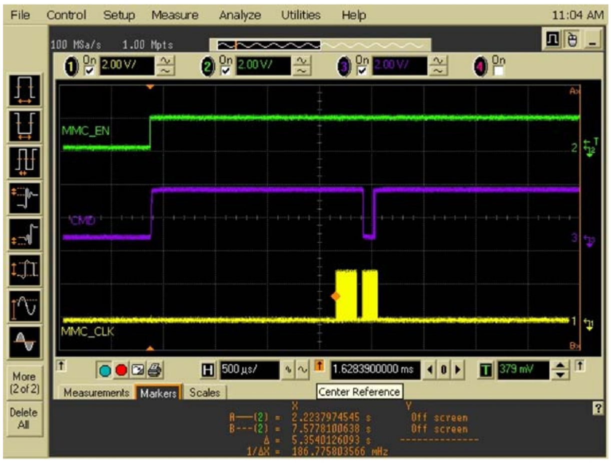
```
Acquisition is stopped.
500 kSa/s    1.00 Mpts
```

```
                  X                    Y
A——(1) =     0.0 s               45 mV
B---(2) =    1.00247715 s         6 mV
      Δ =    1.00247715 s       -39 mV
   1/ΔX =    997.529 mHz
```

MicroSD interface signals timing when door is closed.


Data2 CMD CLK Data0
Data3 VSD GND Data1

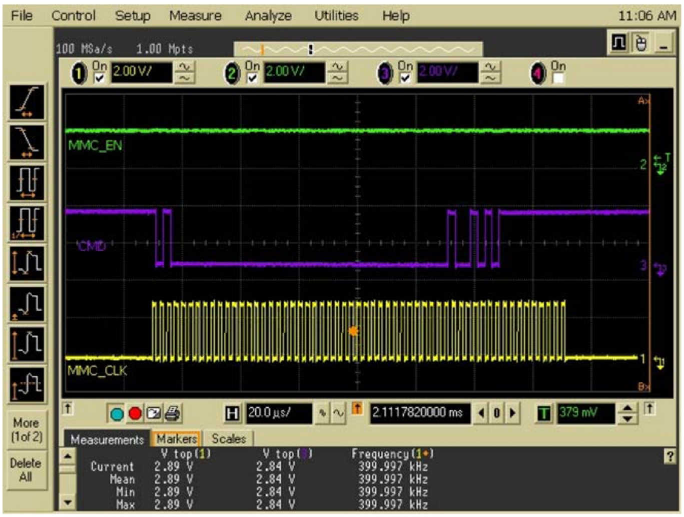
MicroSD connector


File Control Setup Measure Analyze Utilities Help 11:04 AM
1 On 2.00 V/
2 On 2.00 V/
3 On 2.00 V/
4 On
MMC_EN
CMD
MMC_CLK
H 500 µs/
1.6283900000 ms
T 379 mV
Measurements Markers Scales
Center Reference
More (2 of 2)
Delete All

```
100 MSa/s    1.00 Mpts
```

```
                  X                    Y
A——(2) =     2.2237974545 s        Off screen
B---(2) =    7.5778100638 s        Off screen
      Δ =    5.3540126093 s      --------------
   1/ΔX =    186.775803566 mHz
```

CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector.


File Control Setup Measure Analyze Utilities Help 11:06 AM
1 On 2.00 V/
2 On 2.00 V/
3 On 2.00 V/
4 On
MMC_EN
CMD
MMC_CLK
H 20.0 µs/
2.1117820000 ms
T 379 mV
Measurements Markers Scales
More (1 of 2)
Delete All

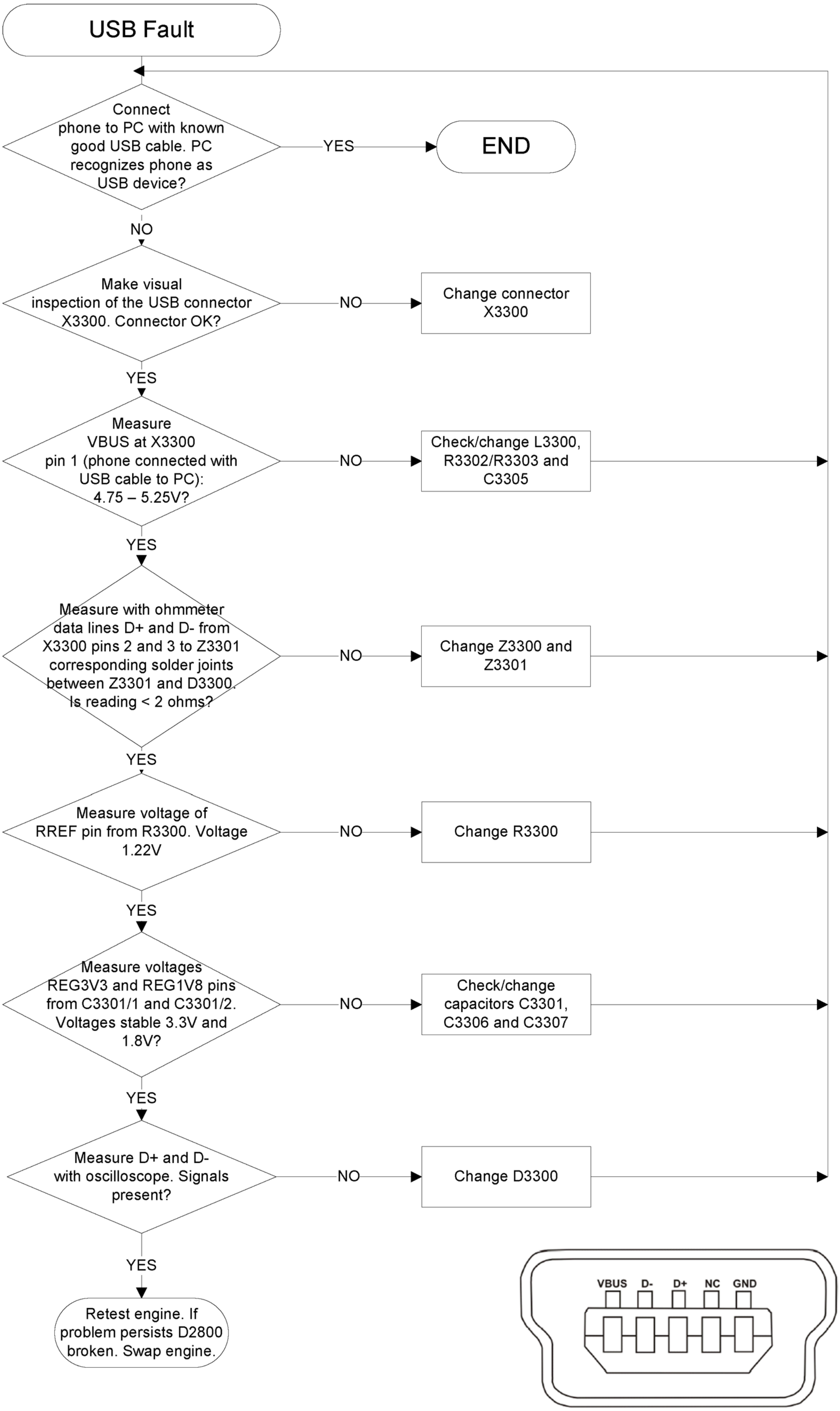
```
100 MSa/s    1.00 Mpts
```

```
          V top(1)     V top(3)     Frequency(1↑)
Current   2.89 V       2.84 V       399.997 kHz
   Mean   2.89 V       2.84 V       399.997 kHz
    Min   2.89 V       2.84 V       399.997 kHz
    Max   2.89 V       2.84 V       399.997 kHz
```

CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector

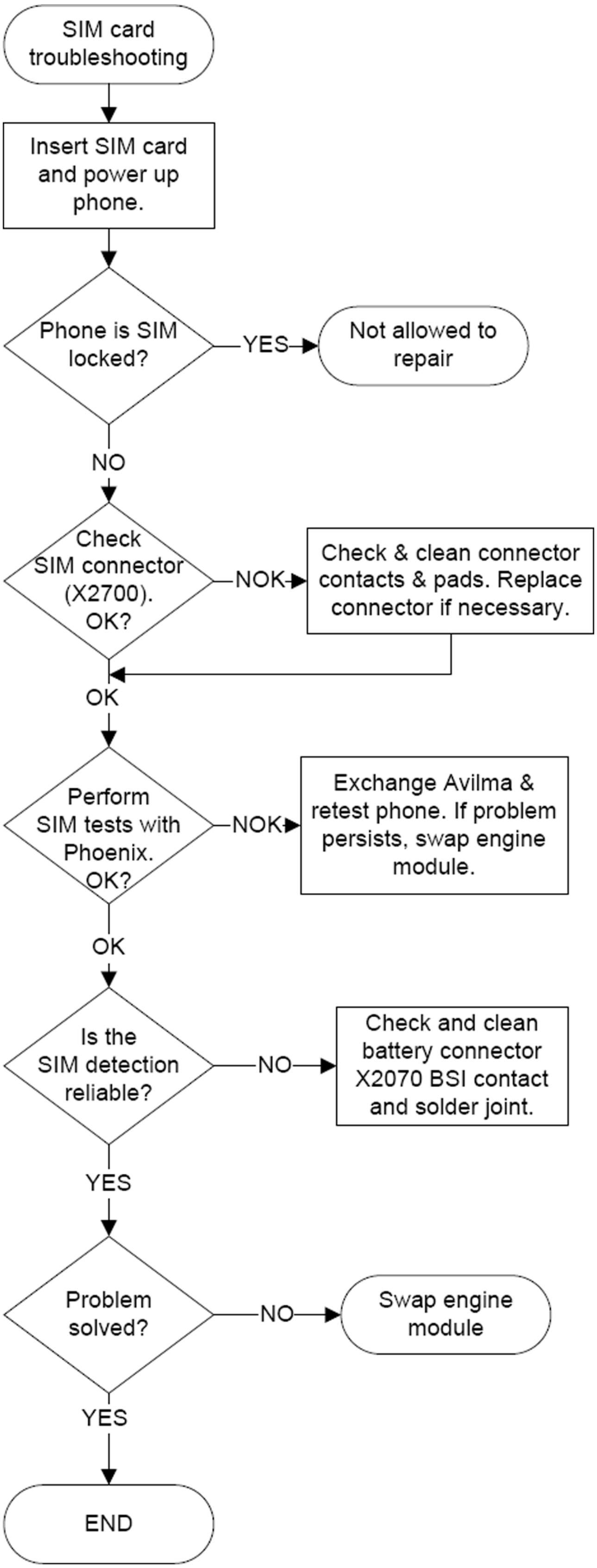
USB troubleshooting

Troubleshooting flow

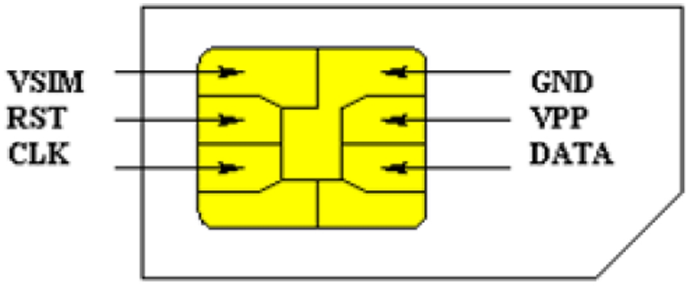

USB Fault
Connect phone to PC with known good USB cable. PC recognizes phone as USB device?
YES
END
NO
Make visual inspection of the USB connector X3300. Connector OK?
NO
Change connector X3300
YES
Measure VBUS at X3300 pin 1 (phone connected with USB cable to PC): 4.75 – 5.25V?
NO
Check/change L3300, R3302/R3303 and C3305
YES
Measure with ohmmeter data lines D+ and D- from X3300 pins 2 and 3 to Z3301 corresponding solder joints between Z3301 and D3300. Is reading < 2 ohms?
NO
Change Z3300 and Z3301
YES
Measure voltage of RREF pin from R3300. Voltage 1.22V
NO
Change R3300
YES
Measure voltages REG3V3 and REG1V8 pins from C3301/1 and C3301/2. Voltages stable 3.3V and 1.8V?
NO
Check/change capacitors C3301, C3306 and C3307
YES
Measure D+ and D- with oscilloscope. Signals present?
NO
Change D3300
YES
Retest engine. If problem persists D2800 broken. Swap engine.
VBUS
D-
D+
NC
GND

SIM card troubleshooting

Troubleshooting flow


SIM card troubleshooting
Insert SIM card and power up phone.
Phone is SIM locked?
YES
Not allowed to repair
NO
Check SIM connector (X2700). OK?
NOK
Check & clean connector contacts & pads. Replace connector if necessary.
OK
Perform SIM tests with Phoenix. OK?
NOK
Exchange Avilma & retest phone. If problem persists, swap engine module.
OK
Is the SIM detection reliable?
NO
Check and clean battery connector X2070 BSI contact and solder joint.
YES
Problem solved?
NO
Swap engine module
YES
END

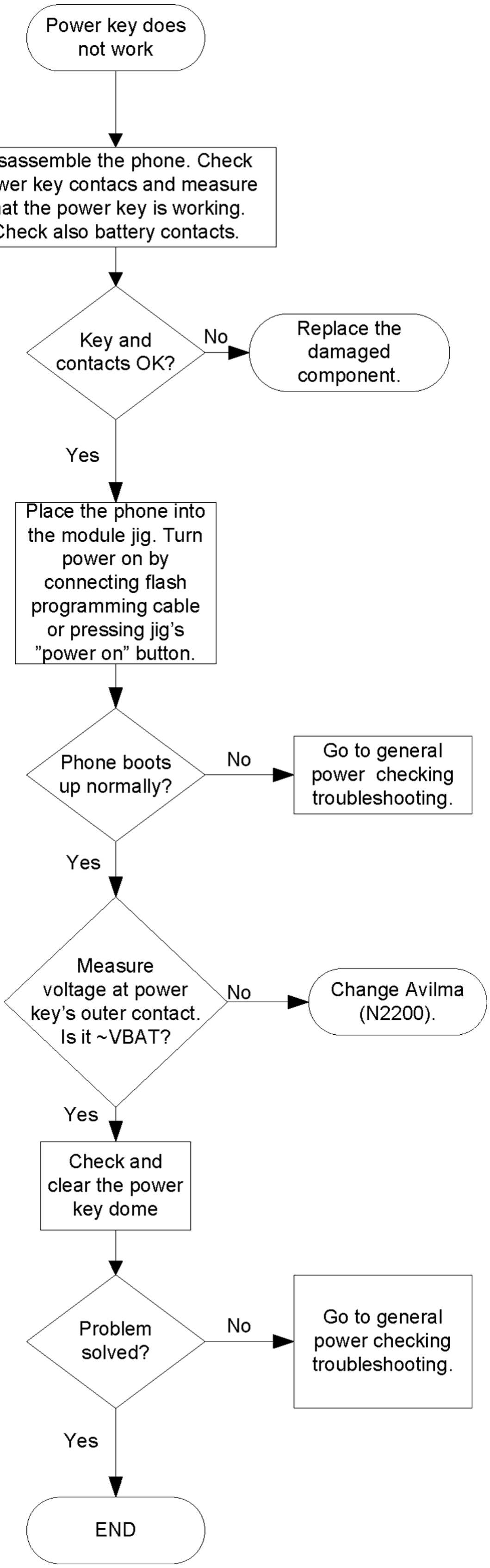
Use module jig when measuring SIM signals. The SIM connector X2700 pins are used as measuring points.


VSIM
RST
CLK
GND
VPP
DATA

SIM contacts

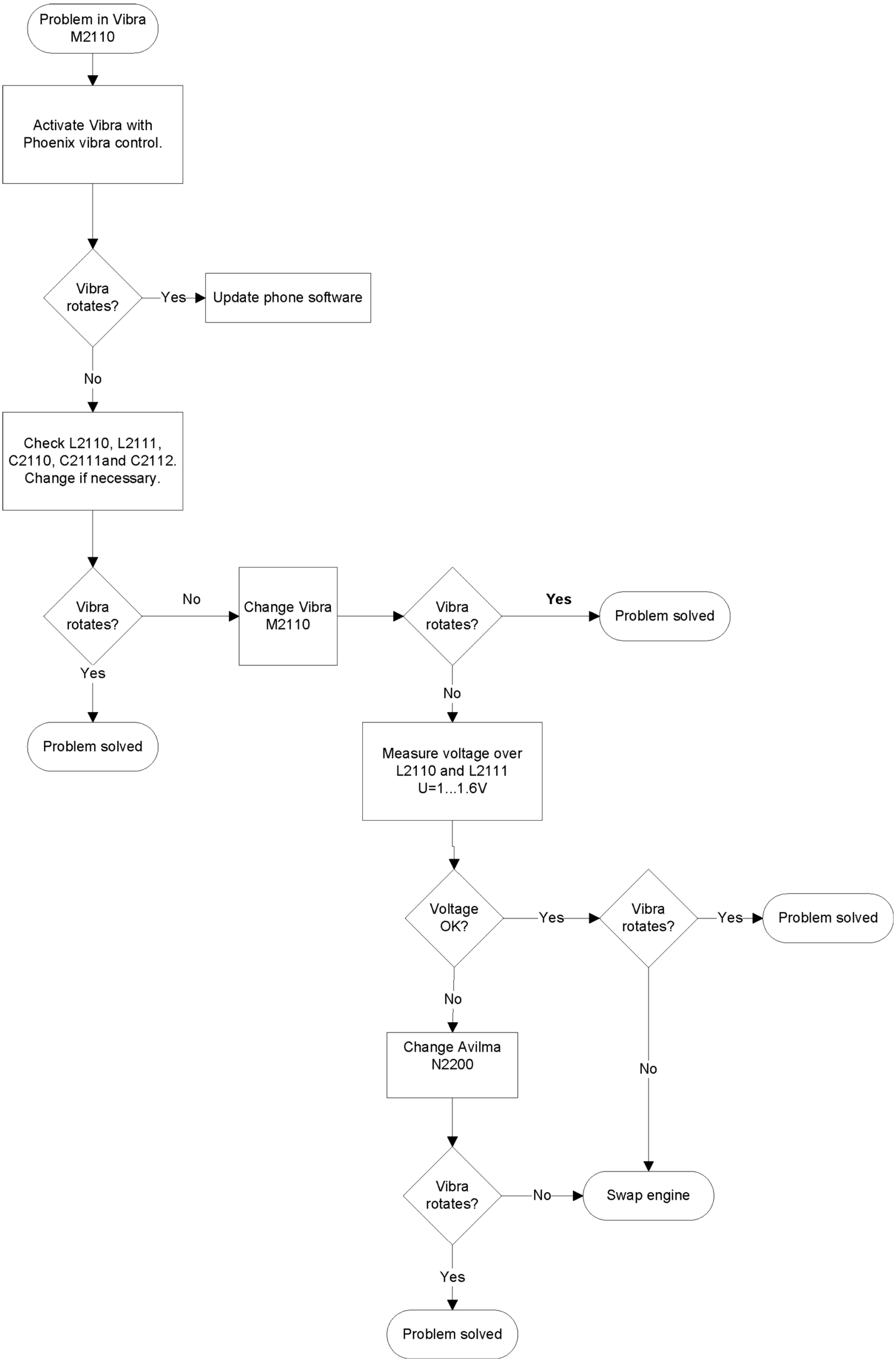
Power key troubleshooting

Troubleshooting flow


Power key does not work
Disassemble the phone. Check power key contacs and measure that the power key is working. Check also battery contacts.
Key and contacts OK?
No
Replace the damaged component.
Yes
Place the phone into the module jig. Turn power on by connecting flash programming cable or pressing jig's "power on" button.
Phone boots up normally?
No
Go to general power checking troubleshooting.
Yes
Measure voltage at power key's outer contact. Is it ~VBAT?
No
Change Avilma (N2200).
Yes
Check and clear the power key dome
Problem solved?
No
Go to general power checking troubleshooting.
Yes
END

Vibra troubleshooting

Troubleshooting flow

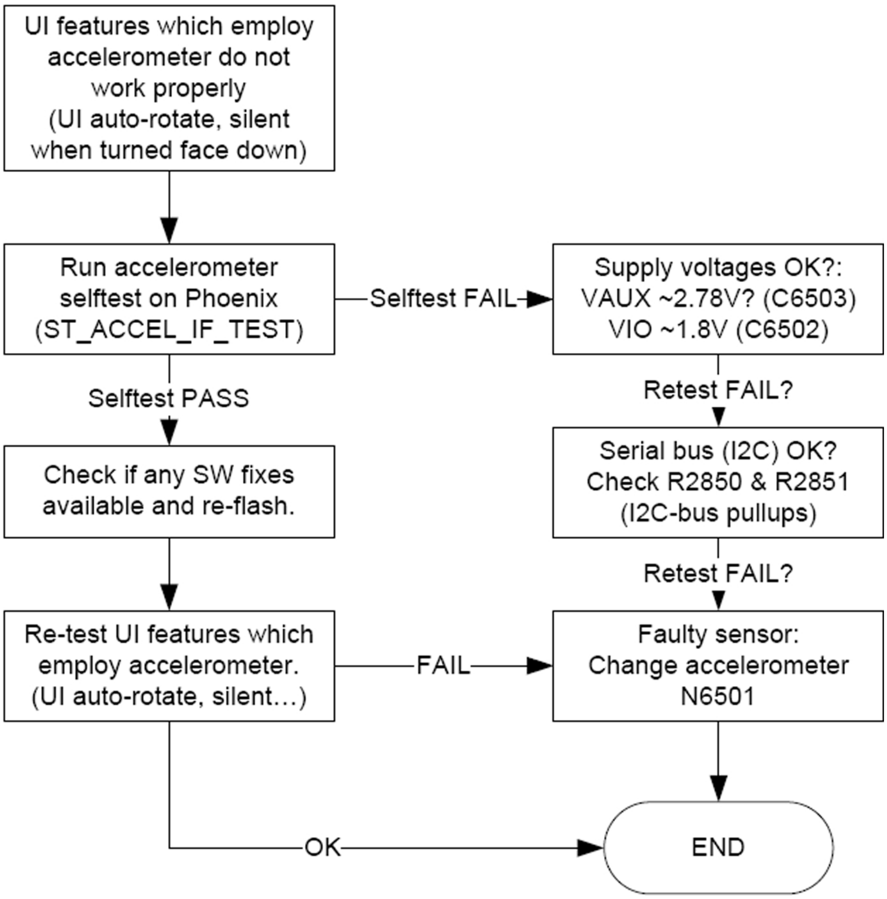

Problem in Vibra M2110
Activate Vibra with Phoenix vibra control.
Vibra rotates?
Yes
Update phone software
No
Check L2110, L2111, C2110, C2111and C2112. Change if necessary.
Vibra rotates?
No
Change Vibra M2110
Vibra rotates?
Yes
Problem solved
Yes
Problem solved
No
Measure voltage over L2110 and L2111 U=1...1.6V
Voltage OK?
Yes
Vibra rotates?
Yes
Problem solved
No
Change Avilma N2200
No
Vibra rotates?
No
Swap engine
Yes
Problem solved

Accelerometer troubleshooting

Troubleshooting flow

Accelerometer selftest: (ST_ACCEL_IF_TEST) verifies the digital parts and the sensor elements inside the component. Selftest is available in LOCAL and TEST modes.

Note! The phone needs to be stable when running the selftest to get correct results. If changes in acceleration are detected by component during the test, it may cause the selftest to fail.


UI features which employ accelerometer do not work properly (UI auto-rotate, silent when turned face down)
Run accelerometer selftest on Phoenix (ST_ACCEL_IF_TEST)
Selftest FAIL
Supply voltages OK?: VAUX ~2.78V? (C6503) VIO ~1.8V (C6502)
Selftest PASS
Retest FAIL?
Check if any SW fixes available and re-flash.
Serial bus (I2C) OK? Check R2850 & R2851 (I2C-bus pullups)
Retest FAIL?
Re-test UI features which employ accelerometer. (UI auto-rotate, silent...)
FAIL
Faulty sensor: Change accelerometer N6501
OK
END

Touch screen troubleshooting

Introduction to touch screen troubleshooting

RM-356 has a resistive touch screen user interface, which means that the device does not have a traditional ITU-T keypad. The key components of the touch screen user interface are:

- Touch window with touch controller (TSC2004)
- Proximity sensor

The resistive touch window is located above the display. It enables finger as well as stylus touch, and it provides tactile feedback. The tactile feedback is implemented by using the same vibra that is used for alerting. The touch controller includes drivers and the control logic to measure touch pressure.

The proximity sensor is attached to the upper flex assembly. It sends out a beam of IR light, and then computes the distance to any nearby objects from the characteristics of the returned (reflected) signal. There is a booth between the sensor and the touch window, which isolates the IR transmitter from the IR receiver by preventing the reflection from the touch window surface.

Proximity sensor troubleshooting

Context

Proximity sensor troubleshooting is broken down into two parts. The main purpose of the automatic check is to identify the fault automatically without any manual checks. If the automatic flow does not provide enough information, a manual check can be done to narrow down the cause of the fault.

Troubleshooting flow

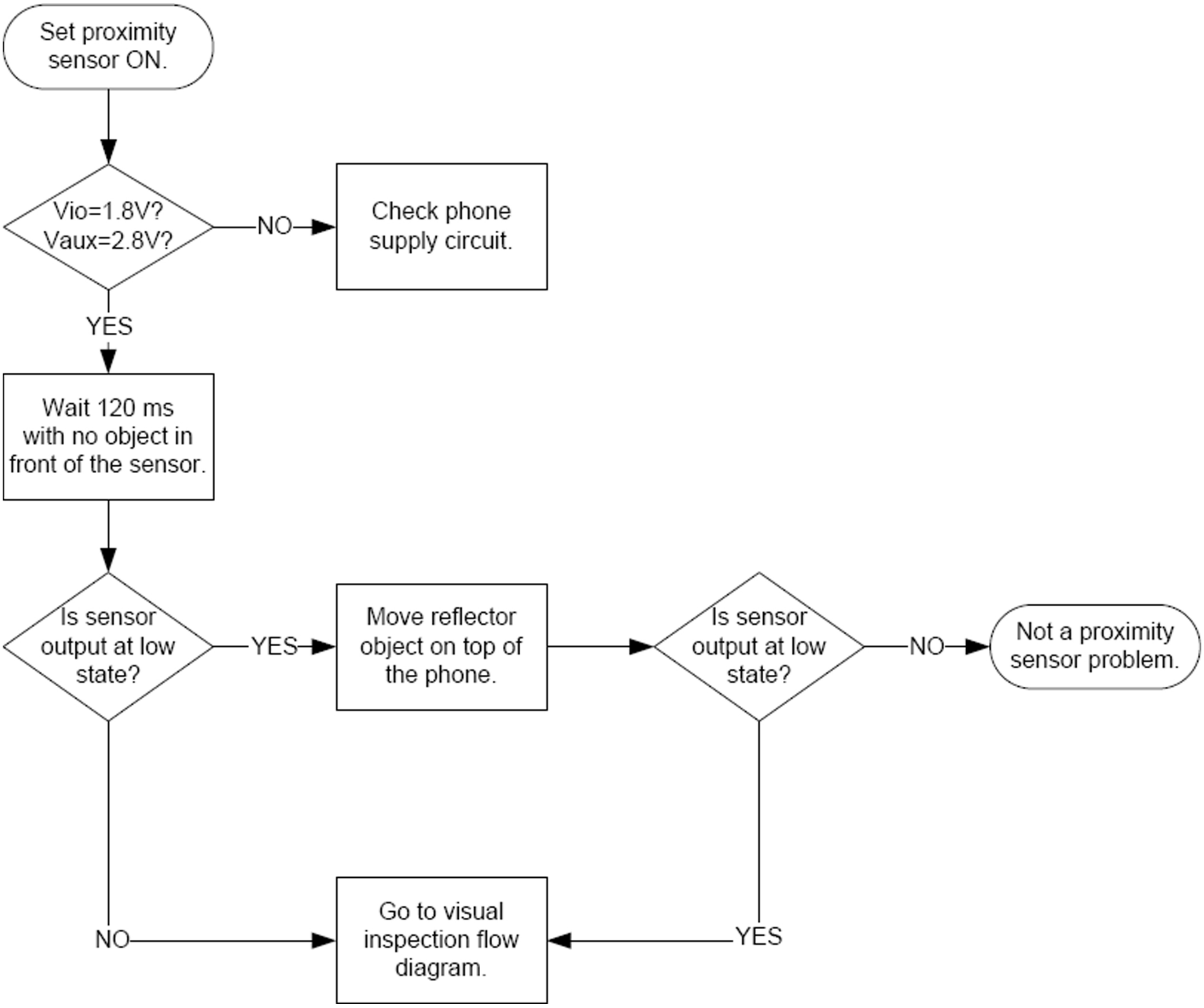

Set proximity sensor ON.
Vio=1.8V? Vaux=2.8V?
NO
Check phone supply circuit.
YES
Wait 120 ms with no object in front of the sensor.
Is sensor output at low state?
YES
Move reflector object on top of the phone.
Is sensor output at low state?
NO
Not a proximity sensor problem.
NO
Go to visual inspection flow diagram.
YES

Figure 12 Proximity sensor troubleshooting - part 1

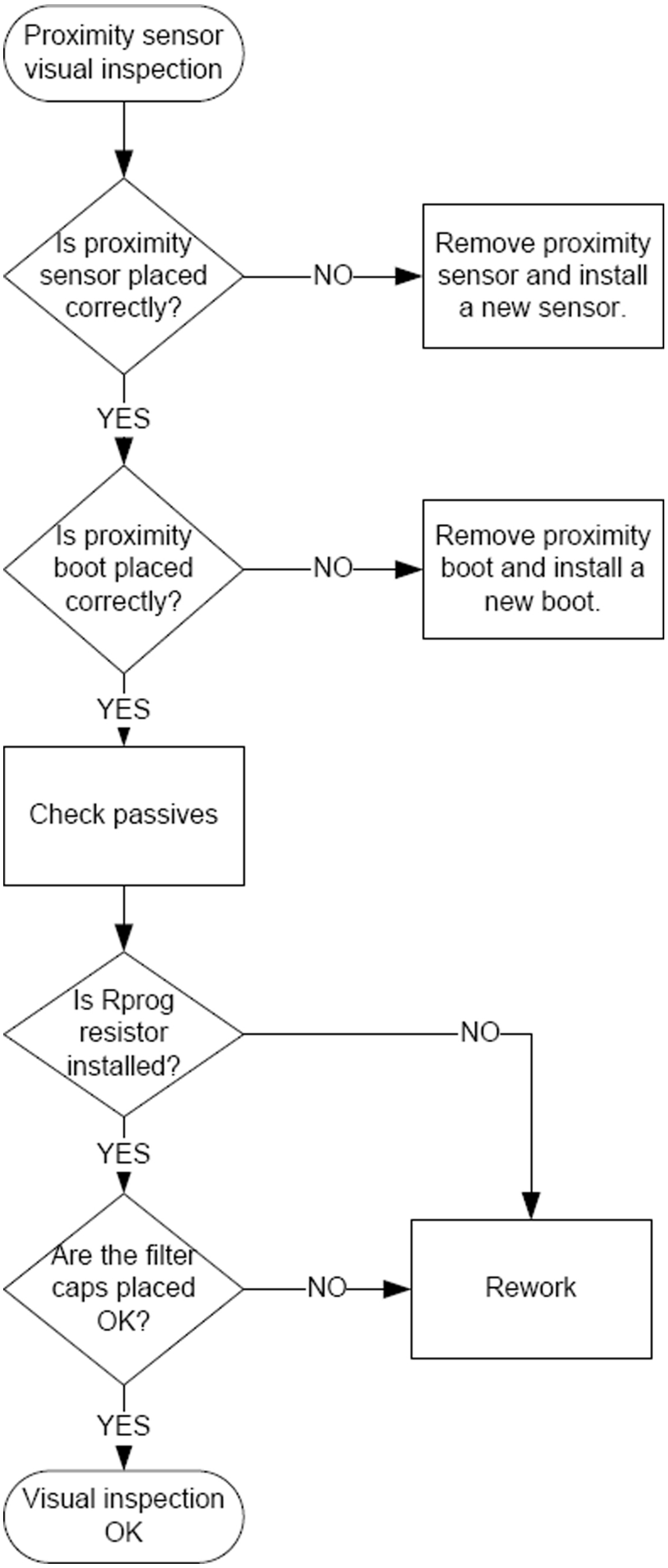
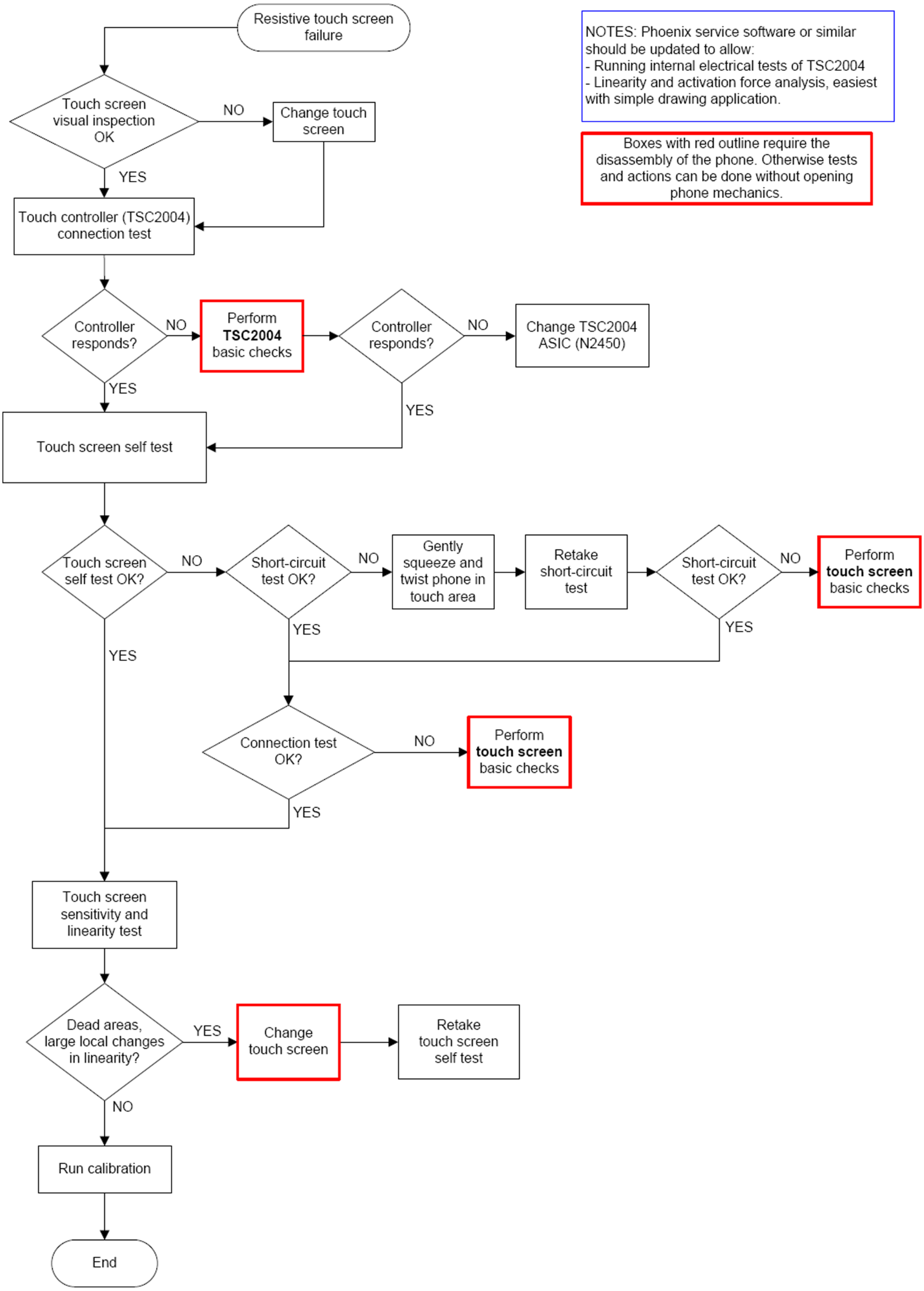

Proximity sensor visual inspection
Is proximity sensor placed correctly?
NO
Remove proximity sensor and install a new sensor.
YES
Is proximity boot placed correctly?
NO
Remove proximity boot and install a new boot.
YES
Check passives
Is Rprog resistor installed?
NO
YES
Are the filter caps placed OK?
NO
Rework
YES
Visual inspection OK

Figure 13 Proximity sensor troubleshooting - part 2

Resistive touch screen troubleshooting

Troubleshooting flow


Resistive touch screen failure
Touch screen visual inspection OK
NO
Change touch screen
YES
Touch controller (TSC2004) connection test
Controller responds?
NO
Perform **TSC2004** basic checks
Controller responds?
NO
Change TSC2004 ASIC (N2450)
YES
YES
Touch screen self test
Touch screen self test OK?
NO
Short-circuit test OK?
NO
Gently squeeze and twist phone in touch area
Retake short-circuit test
Short-circuit test OK?
NO
Perform **touch screen** basic checks
YES
YES
YES
Connection test OK?
NO
Perform **touch screen** basic checks
YES
Touch screen sensitivity and linearity test
Dead areas, large local changes in linearity?
YES
Change touch screen
Retake touch screen self test
NO
Run calibration
End

NOTES: Phoenix service software or similar should be updated to allow:
- Running internal electrical tests of TSC2004
- Linearity and activation force analysis, easiest with simple drawing application.

Boxes with red outline require the disassembly of the phone. Otherwise tests and actions can be done without opening phone mechanics.

Figure 14 Resistive touch screen troubleshooting

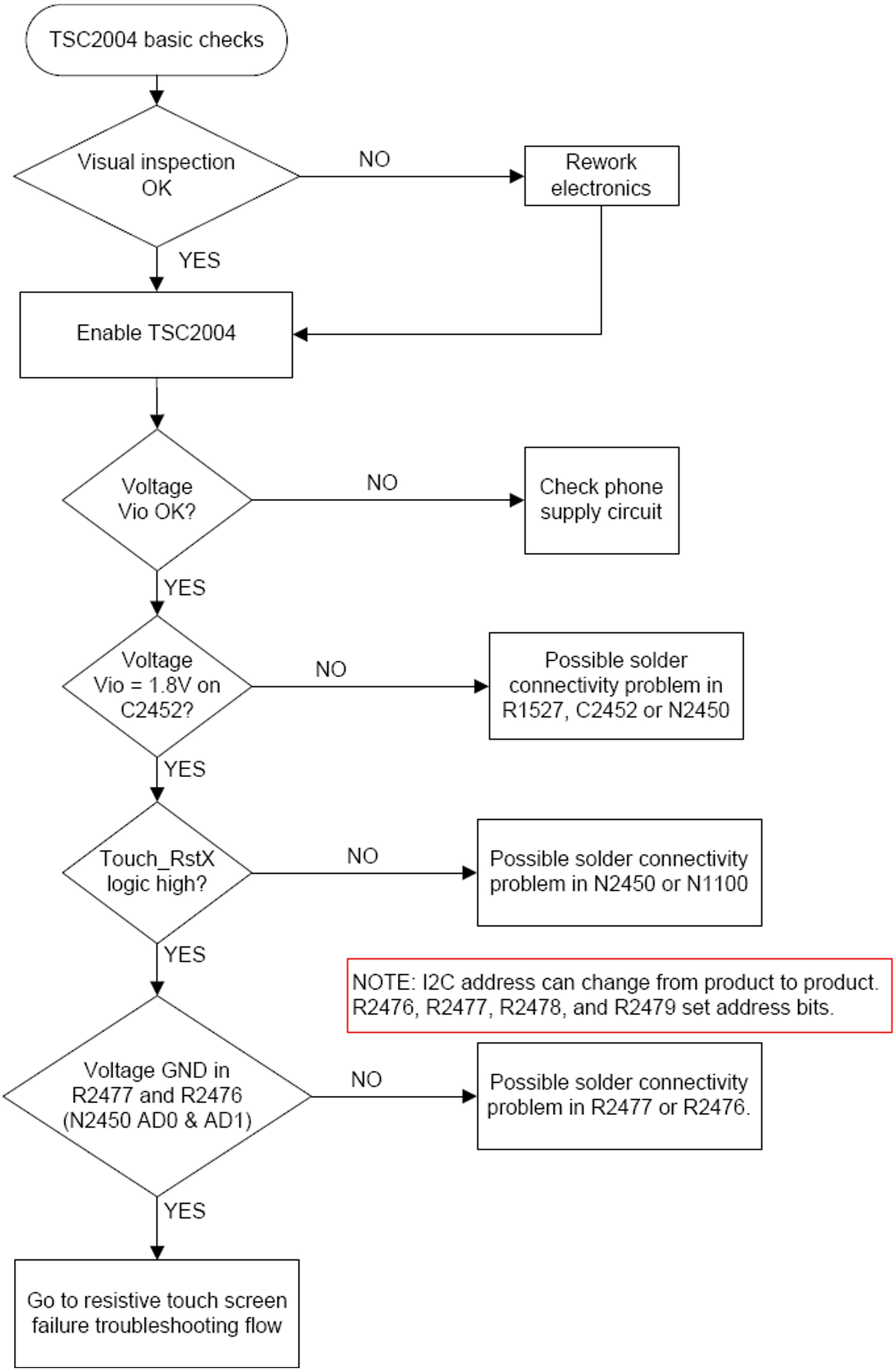

TSC2004 basic checks
Visual inspection OK
NO
Rework electronics
YES
Enable TSC2004
Voltage Vio OK?
NO
Check phone supply circuit
YES
Voltage Vio = 1.8V on C2452?
NO
Possible solder connectivity problem in R1527, C2452 or N2450
YES
Touch_RstX logic high?
NO
Possible solder connectivity problem in N2450 or N1100
YES
NOTE: I2C address can change from product to product. R2476, R2477, R2478, and R2479 set address bits.
Voltage GND in R2477 and R2476 (N2450 AD0 & AD1)
NO
Possible solder connectivity problem in R2477 or R2476.
YES
Go to resistive touch screen failure troubleshooting flow

Figure 15 Touch controller basic checks

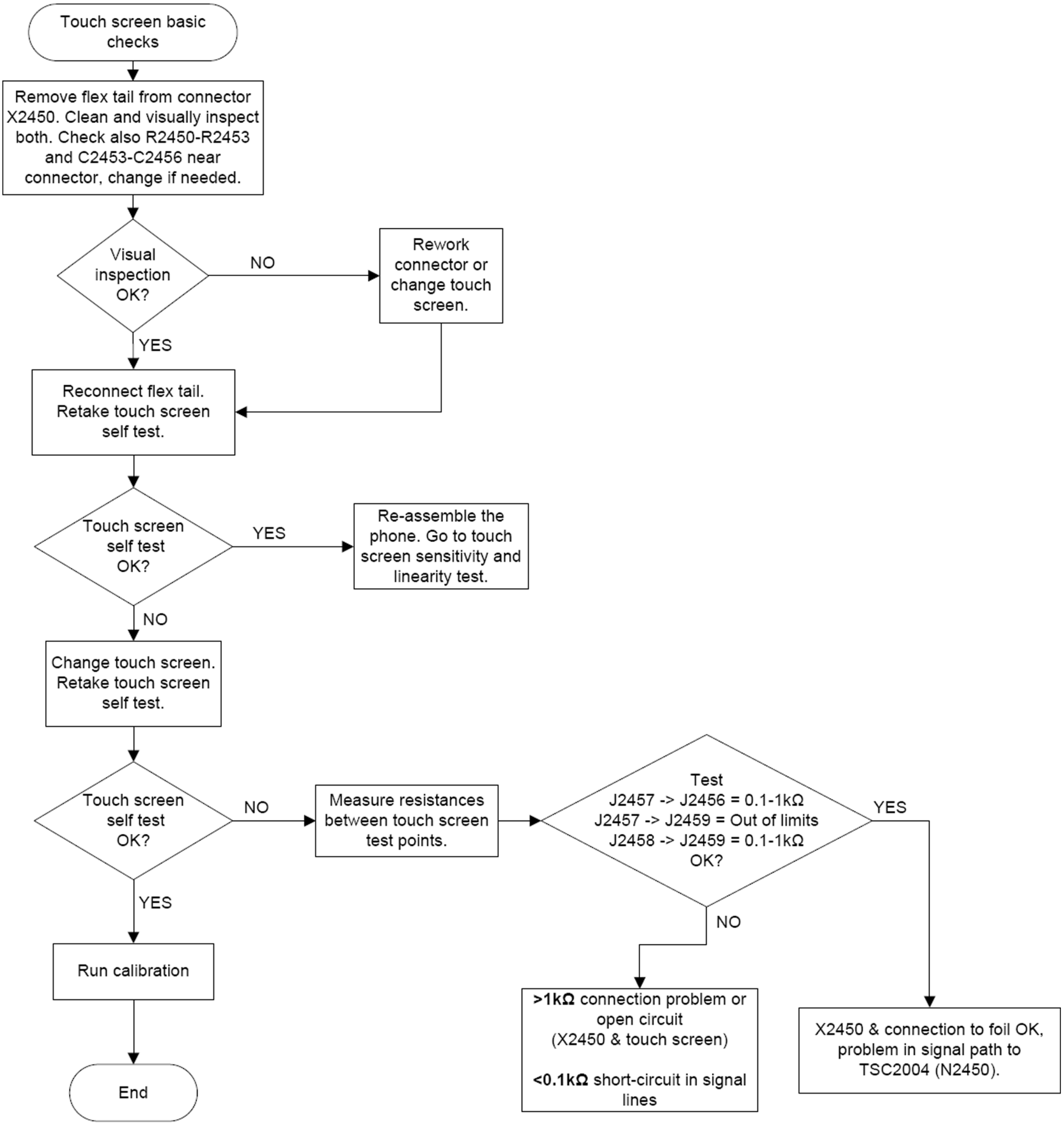

Touch screen basic checks
Remove flex tail from connector X2450. Clean and visually inspect both. Check also R2450-R2453 and C2453-C2456 near connector, change if needed.
Visual inspection OK?
NO
Rework connector or change touch screen.
YES
Reconnect flex tail. Retake touch screen self test.
Touch screen self test OK?
YES
Re-assemble the phone. Go to touch screen sensitivity and linearity test.
NO
Change touch screen. Retake touch screen self test.
Touch screen self test OK?
NO
Measure resistances between touch screen test points.
Test J2457 -> J2456 = 0.1-1kΩ J2457 -> J2459 = Out of limits J2458 -> J2459 = 0.1-1kΩ OK?
YES
NO
YES
Run calibration
End
>1kΩ connection problem or open circuit (X2450 & touch screen)
<0.1kΩ short-circuit in signal lines
X2450 & connection to foil OK, problem in signal path to TSC2004 (N2450).

Figure 16 Touch screen basic checks

Hardware keys troubleshooting

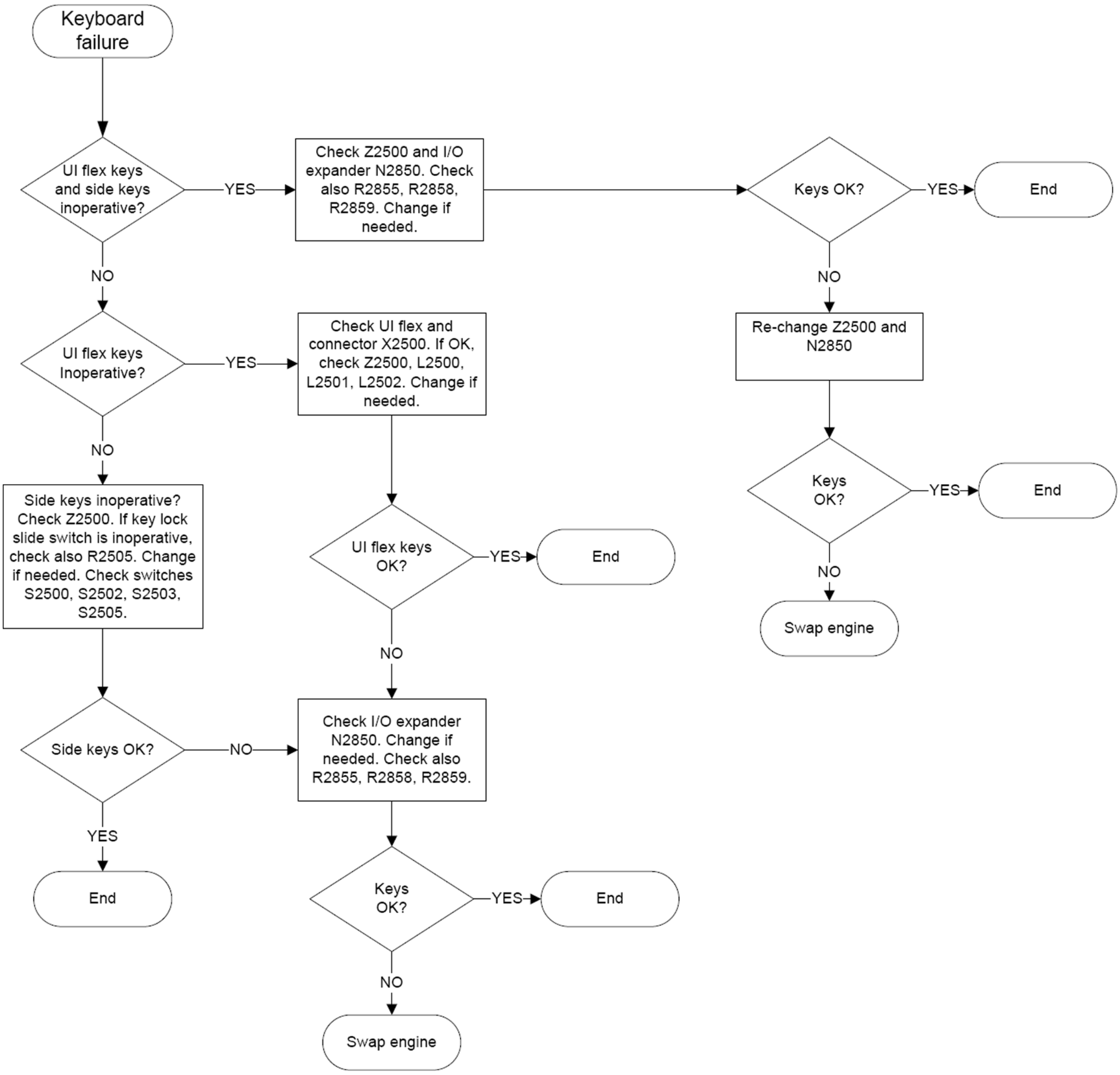
Context

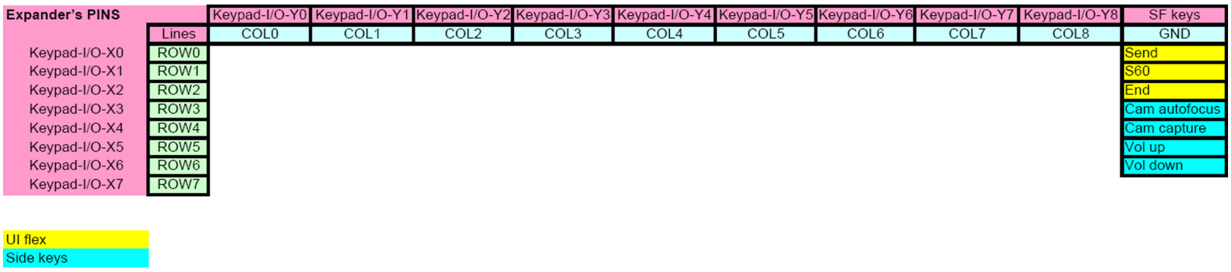
There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust).
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcircuit or open connection).

If the failure mode is not clear, start with the Keyboard Test in Phoenix.

Troubleshooting flow


Keyboard failure
UI flex keys and side keys inoperative?
YES
Check Z2500 and I/O expander N2850. Check also R2855, R2858, R2859. Change if needed.
Keys OK?
YES
End
NO
Re-change Z2500 and N2850
Keys OK?
YES
End
NO
Swap engine
NO
UI flex keys Inoperative?
YES
Check UI flex and connector X2500. If OK, check Z2500, L2500, L2501, L2502. Change if needed.
UI flex keys OK?
YES
End
NO
NO
Side keys inoperative? Check Z2500. If key lock slide switch is inoperative, check also R2505. Change if needed. Check switches S2500, S2502, S2503, S2505.
Side keys OK?
NO
Check I/O expander N2850. Change if needed. Check also R2855, R2858, R2859.
Keys OK?
YES
End
NO
Swap engine
YES
End



Expander's PINS		Keypad-I/O-Y0	Keypad-I/O-Y1	Keypad-I/O-Y2	Keypad-I/O-Y3	Keypad-I/O-Y4	Keypad-I/O-Y5	Keypad-I/O-Y6	Keypad-I/O-Y7	Keypad-I/O-Y8	SF keys
	Lines	COL0	COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8	GND
Keypad-I/O-X0	ROW0										Send
Keypad-I/O-X1	ROW1										S60
Keypad-I/O-X2	ROW2										End
Keypad-I/O-X3	ROW3										Cam autofocus
Keypad-I/O-X4	ROW4										Cam capture
Keypad-I/O-X5	ROW5										Vol up
Keypad-I/O-X6	ROW6										Vol down
Keypad-I/O-X7	ROW7										

UI flex
Side keys

Figure 17 Keymatrix

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 9 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 10 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   Note: The display module cannot be repaired.

2. Check that the cellular engine is working normally.
    i To check the functionality, connect the phone to a docking station.
    ii Start *Phoenix* service software.
    iii Read the phone information to check that the engine is functioning normally (you should be able to read the Phone ID).
3. Proceed to the display troubleshooting flowcharts.

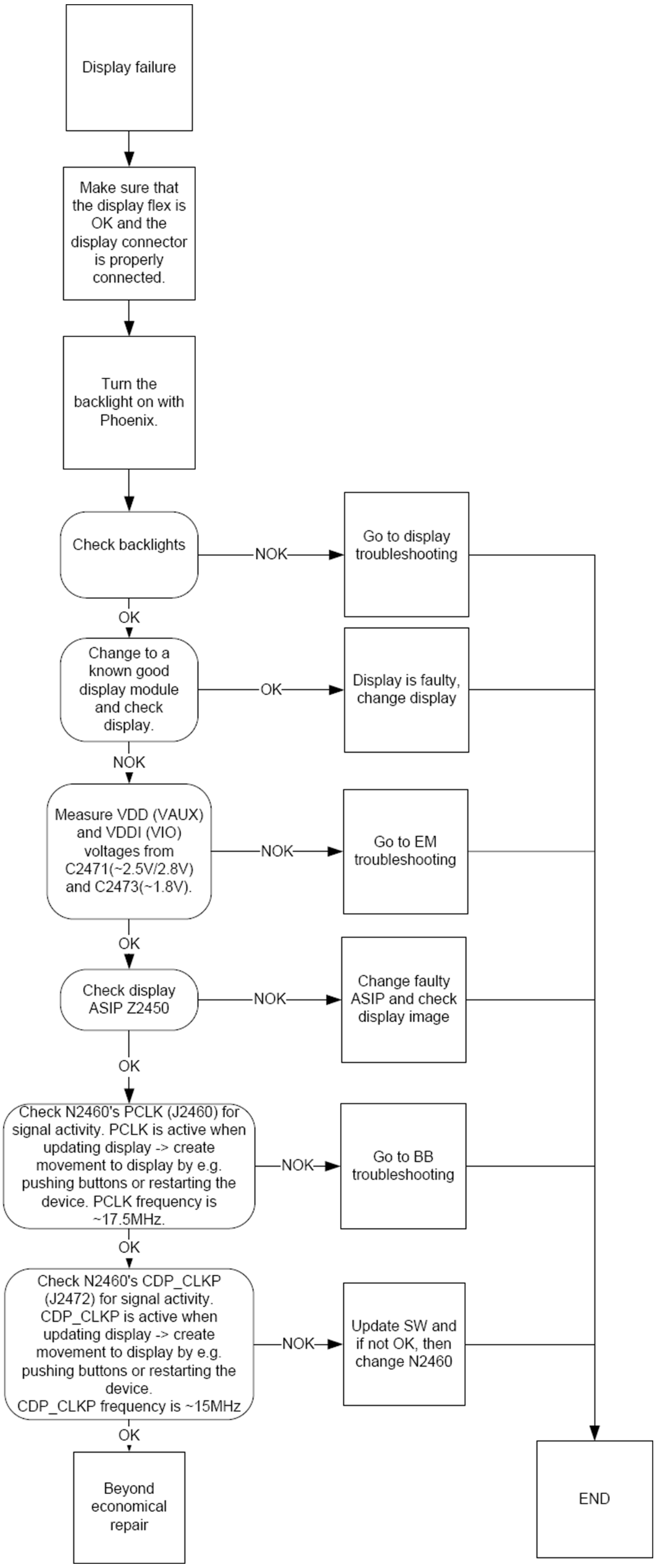
    Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

Before going to display troubleshooting flow, make sure that the engine is working and starting up correctly. If the problem is in the engine, go to baseband troubleshooting.

Troubleshooting flow


Display failure
Make sure that the display flex is OK and the display connector is properly connected.
Turn the backlight on with Phoenix.
Check backlights
NOK
Go to display troubleshooting
OK
Change to a known good display module and check display.
OK
Display is faulty, change display
NOK
Measure VDD (VAUX) and VDDI (VIO) voltages from C2471(~2.5V/2.8V) and C2473(~1.8V).
NOK
Go to EM troubleshooting
OK
Check display ASIP Z2450
NOK
Change faulty ASIP and check display image
OK
Check N2460's PCLK (J2460) for signal activity. PCLK is active when updating display -> create movement to display by e.g. pushing buttons or restarting the device. PCLK frequency is ~17.5MHz.
NOK
Go to BB troubleshooting
OK
Check N2460's CDP_CLKP (J2472) for signal activity. CDP_CLKP is active when updating display -> create movement to display by e.g. pushing buttons or restarting the device. CDP_CLKP frequency is ~15MHz
NOK
Update SW and if not OK, then change N2460
OK
Beyond economical repair
END

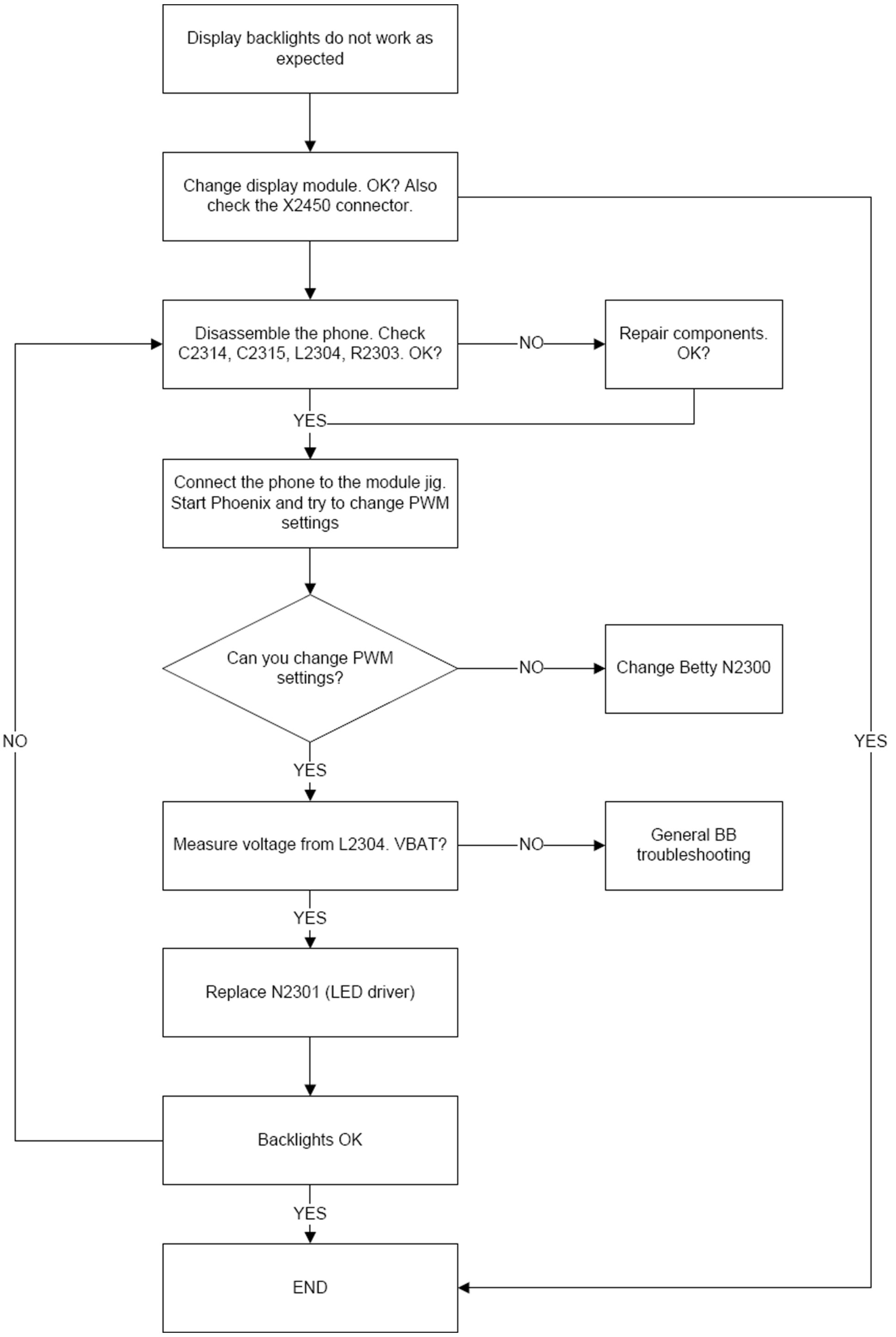
Display backlights troubleshooting

Context

The device has three LED drivers. One of the drivers provides current for the display backlights. The display backlights can be turned ON (100% max.) and OFF (0%) with PWM.

The two other LED drivers provide current for the keyboard backlights. The keyboard backlights can be turned ON/OFF separately.

Troubleshooting flow

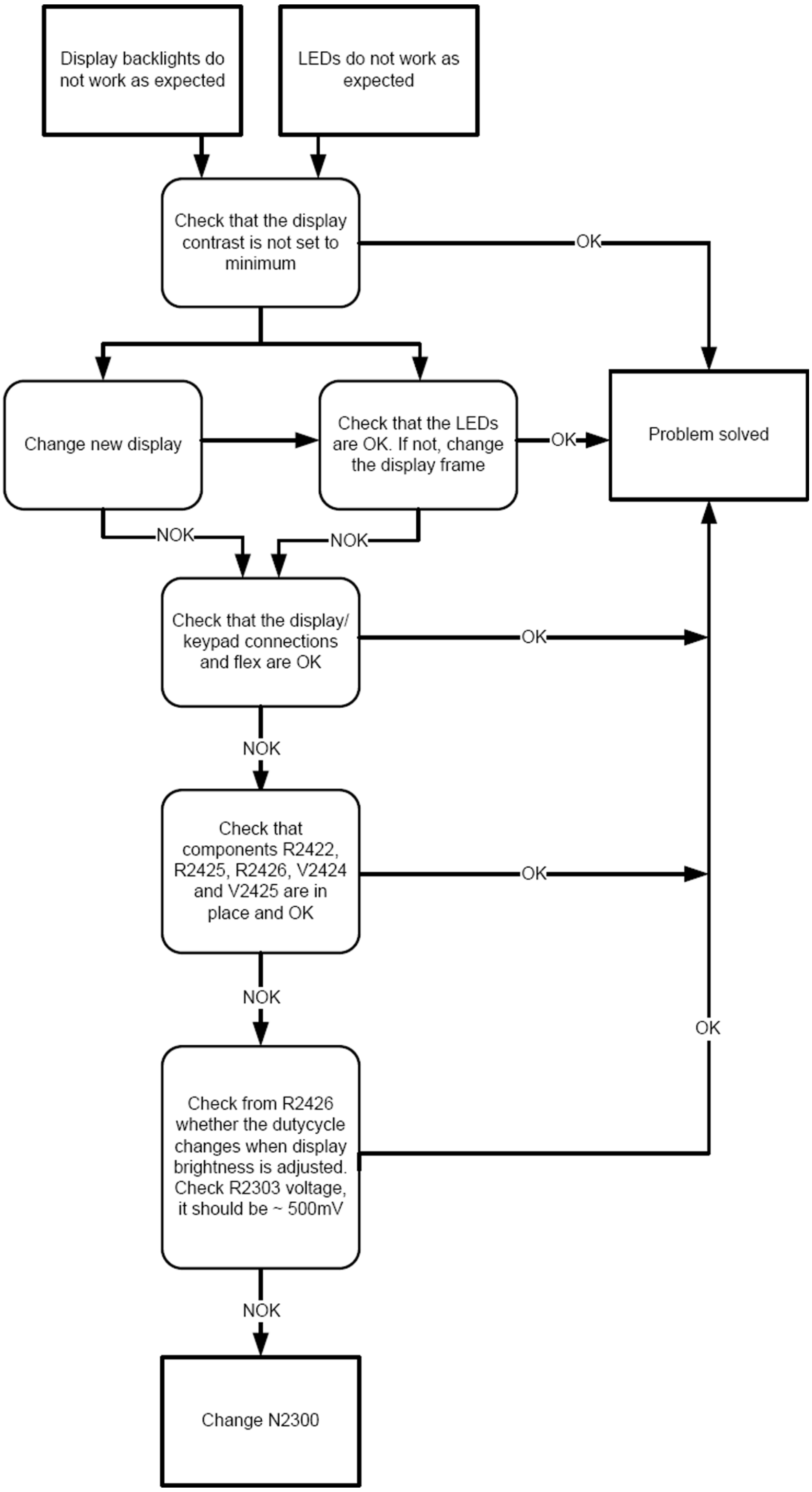

Display backlights do not work as expected
Change display module. OK? Also check the X2450 connector.
Disassemble the phone. Check C2314, C2315, L2304, R2303. OK?
NO
Repair components. OK?
YES
Connect the phone to the module jig. Start Phoenix and try to change PWM settings
Can you change PWM settings?
NO
Change Betty N2300
YES
Measure voltage from L2304. VBAT?
NO
General BB troubleshooting
YES
Replace N2301 (LED driver)
Backlights OK
YES
END
NO
YES

Backlights and LED driver troubleshooting

Context

The device has one LED driver that provides current for both the display and keyboard backlights. Brightness can be adjusted manually, and it affects both the display and keypad. Keyboard backlights can be turned ON/OFF separately but not without switching on the display lights.

Troubleshooting flow


Display backlights do not work as expected
LEDs do not work as expected
Check that the display contrast is not set to minimum
OK
Change new display
Check that the LEDs are OK. If not, change the display frame
OK
Problem solved
NOK
NOK
Check that the display/ keypad connections and flex are OK
OK
NOK
Check that components R2422, R2425, R2426, V2424 and V2425 are in place and OK
OK
NOK
OK
Check from R2426 whether the dutycycle changes when display brightness is adjusted. Check R2303 voltage, it should be ~ 500mV
NOK
Change N2300

Ambient Light Sensor troubleshooting and re-calibration

Introduction to ALS troubleshooting and re-calibration

If the Ambient Light Sensor (ALS) functionality is inoperative, check the ambient light sensor (N6502) and change it, if necessary. Also, check the capacitor C6504 (100n).

The ALS components are located at the top of the UI flex as illustrated in the figure below.

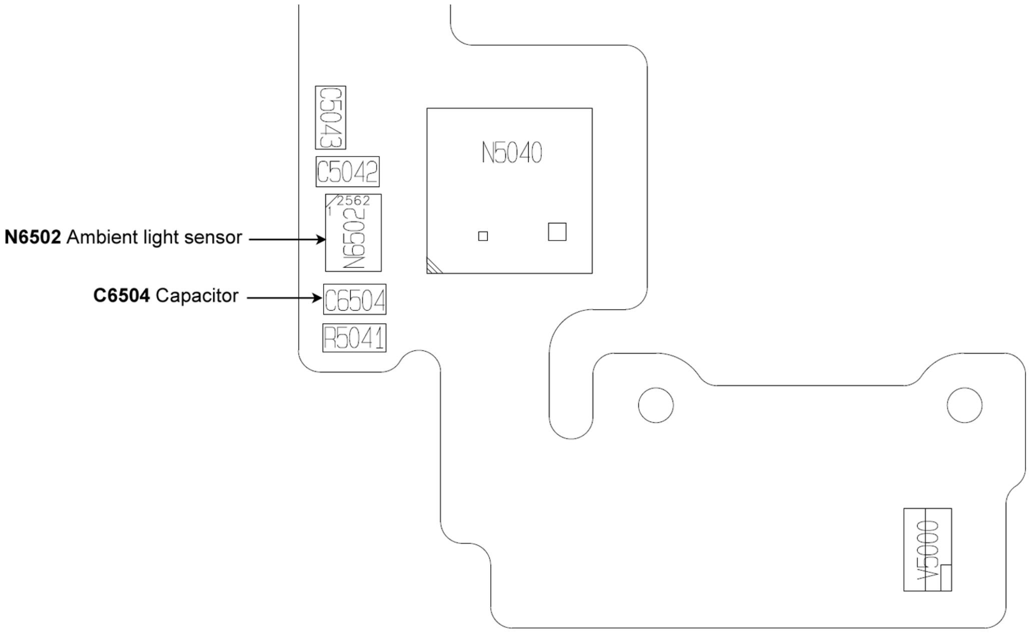


Figure 18 ALS components

ALS information is used to control the keypad and display brightness of the phone. The keyboard backlight is turned OFF, when it's not needed. Display brightness is dimmed, when environment lighting is dark. ALS is calibrated in production and can be re-tuned in service points though not recommended unless calibration coefficient is lost for some reason.

> **Note:** ALS calibration is also required for Light SWAP Engines, because ALS is not factory calibrated for Light SWAP.

When executing the ALS calibration, a reference phone that includes calibrated ALS is required. The ALS re-tuning instructions show why the reference phone is needed.

> **Note:** Make sure that you have completed the display and keyboard backlights troubleshooting before starting the ALS troubleshooting.

There is an Ambient Light Sensor window in the Phoenix Display Test tool, which shows the luminance value. The correct luminance in darkness is <20 lx, and in an office environment 100-2000 lx.

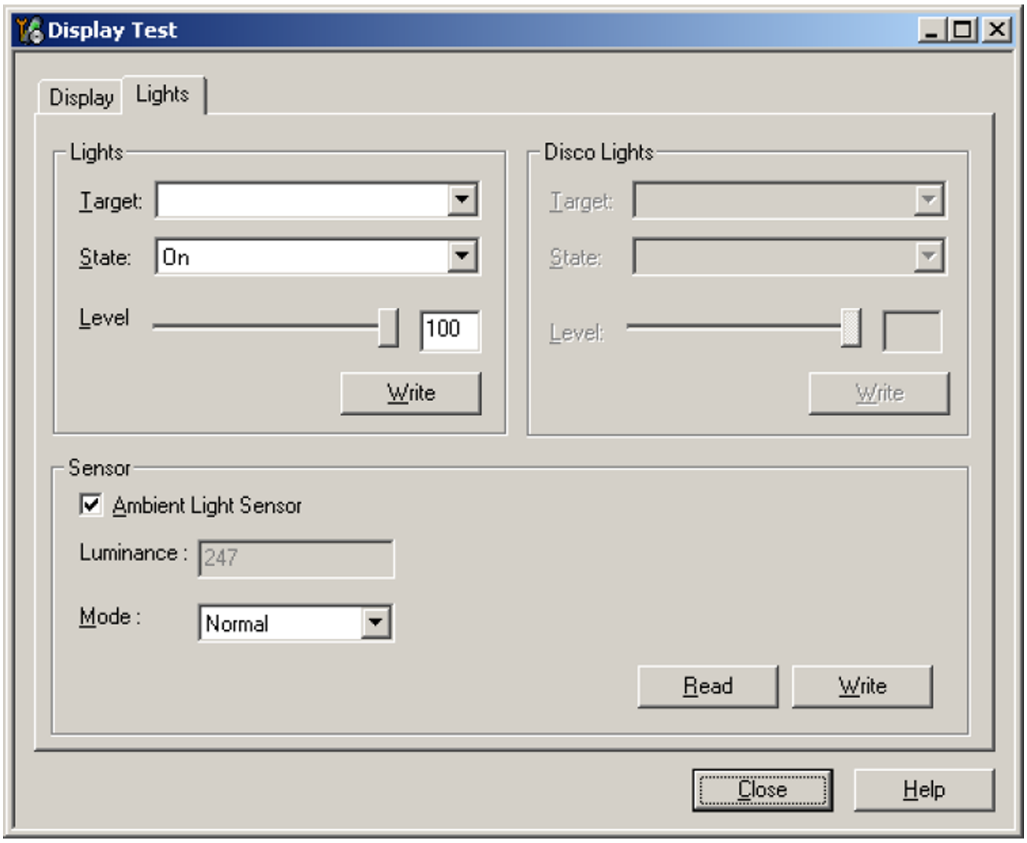
> **Note:** The luminance value depends heavily on the light source and the angle of the phone against the light source, so the values above can only be used as a rough guideline. Phoenix has an ambient light sensor calibration tool for changing the calibration values.

Ambient Light Sensor calibration

Functionality check

Steps

1. Connect the phone to *Phoenix*, start the *Phoenix* software, and set the phone (e.g. on the table) so that the ambient light visible to ALS is stable. The light quide of the ALS is located on the upper part of the phone’s front cover, right next to the secondary camera.
2. Scan product on Phoenix (**CTRL+R**)
3. Choose **Testing→Display test.**



Display Test

Lights

Target:

State: On

Level 100

Sensor

☑ Ambient Light Sensor

Luminance : 247

Mode : Normal

4. Open the **Lights** tab, and check the Ambient light sensor check box. Click the **Read** button in order to get the reference ambient light value. Cover the sensor and click **Read** again. When covered, the luminance reading should be less than after clicking **Read** without covering the sensor.
5. If the component does not give any reading or the reading does not change when sensor is/is not covered, replace the part.

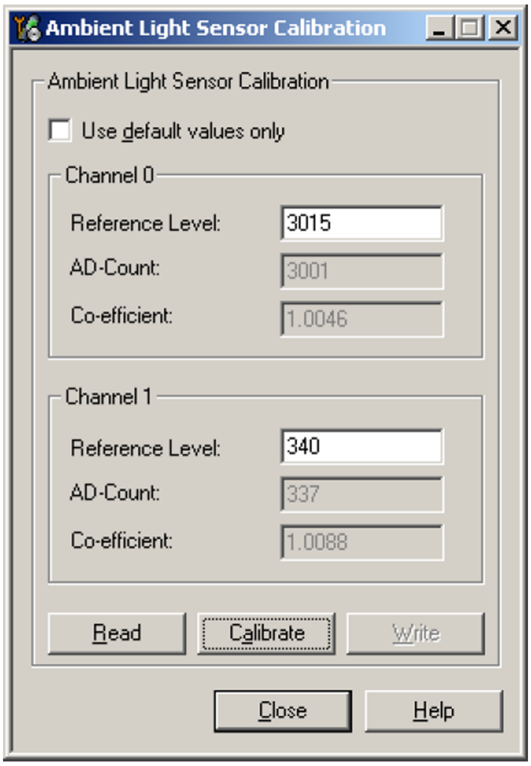
   Note: In RM-356 the ALS module is located on the UI flex assembly. ALS calibration must always be done when the UI flex assembly is changed. Also, if the ALS calibration values are lost from the phone, ALS needs to be recalibrated.

   The ALS calibration procedure requires a reference phone with a calibrated ALS.

Calibrating ALS

Steps

1. Connect the phone to *Phoenix*, start the *Phoenix* software, and set the phone (e.g. on the table) so that the ambient light visible to ALS is stable. The light quide of the ALS is located on the upper part of the phone's front cover, right next to the secondary camera.
2. Scan product on Phoenix (**CTRL+R**)
3. Choose **Testing→Ambient Light Sensor Calibration.**



Ambient Light Sensor Calibration

☐ Use default values only

Channel 0
Reference Level: 3015
AD-Count: 3001
Co-efficient: 1.0046

Channel 1
Reference Level: 340
AD-Count: 337
Co-efficient: 1.0088

4. Uncheck the Use default values only check box, click the **Read** button to get the AD-Count values for Channel 0 and Channel 1, and write them down.

   Note: In the example graphic the reference phone values are: Channel 0=3001 and Channel 1=337
5. Repeat steps 1-4 for the phone to be calibrated.

   Note: Make sure the phone to be calibrated is located in the same place as the reference phone was when luminance reading was taken.
6. Calculate and write down co-efficient value by division:

$$\text{Co-efficient(CH0)}=\frac{Channel(0)_{(ref.phone)}}{Channel(0)} \qquad \text{Co-efficient(CH1)}=\frac{Channel(1)_{(ref.phone)}}{Channel(1)}$$

7. To calibrate ALS, the value in the **Reference Level** textbox needs to be adjusted for both channels until the **Co-efficient** calculated by Phoenix equals the values calculated in step 6. Click **Calibrate** after each try (and uncheck the Use default values only check box).
8. Calibration is done when the **Co-efficient** is equal to the co-efficient value calculated in step 6.

   Note: Decimal numbers should be used in the iteration in order to achieve adequate precision (e.g. 200.2455)

9. Use Phoenix (**Testing**→**Display test**→**Lights** tab) to verify the calibration by reading the luminance value for both the reference phone and calibrated phone.

   Note: Remember that the illuminance readings for the reference and calibrated phones must be done in the same ambient light conditions. If the illuminance values differ more than +- 10%, repeat the whole ALS calibration procedure.

10. To end the calibration, click Close.

GPS troubleshooting

GPS antenna

The GPS antenna is located on the back side of the B-cover (right-hand side, next to the battery).

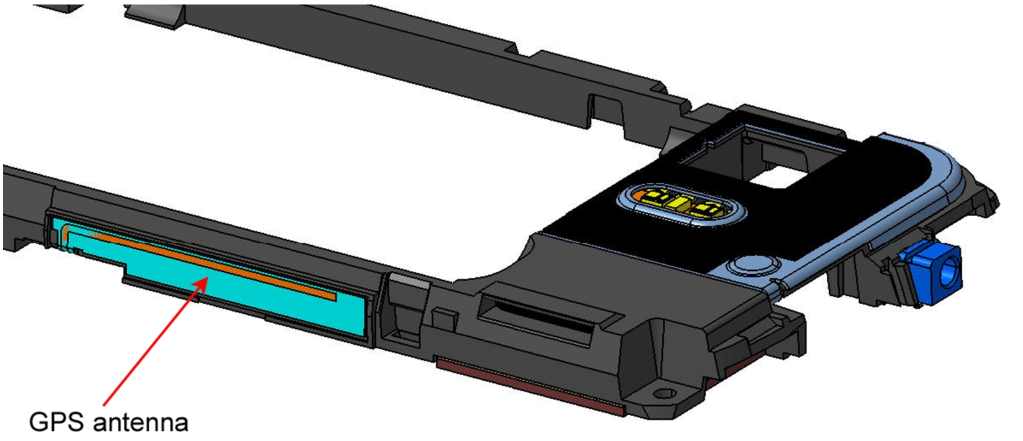


Figure 19 GPS antenna

GPS layout and basic test points

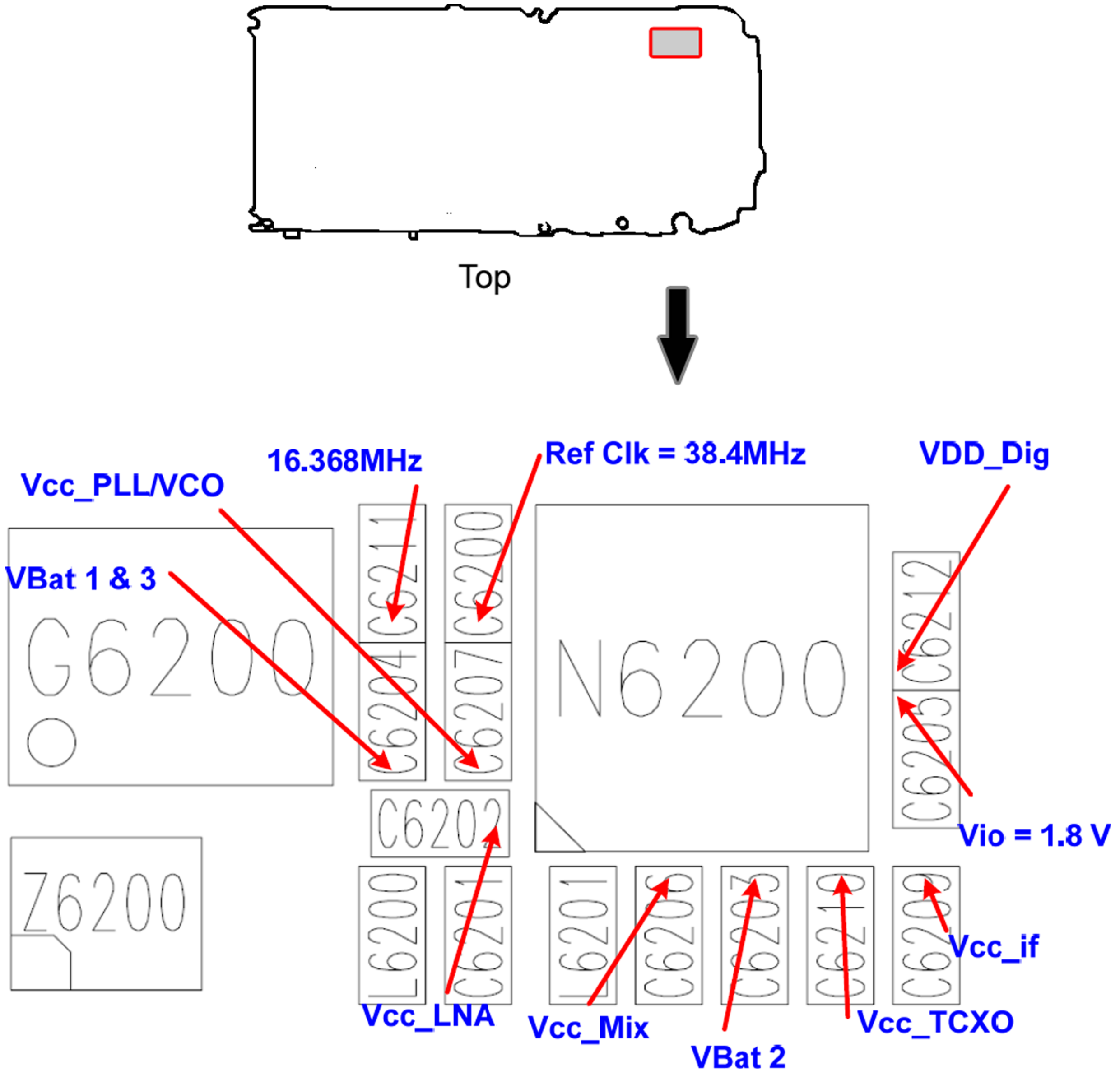

Top
Vcc_PLL/VCO
16.368MHz
Ref Clk = 38.4MHz
VDD_Dig
VBat 1 & 3
G6200
C6211
C6200
C6204
C6207
N6200
C6212
C6205
Vio = 1.8 V
C6202
Z6200
L6200
C6201
L6201
C6206
C6203
C6210
C6209
Vcc_if
Vcc_LNA
Vcc_Mix
VBat 2
Vcc_TCXO

Figure 20 GPS layout and basic test points

VBat, ASIC internal LDO voltages, and clocks are available as shown in figure above. In addition to these, the following GPS signals are available on the test points listed below:

- GPS_En_Reset (J6201)
- U2Tx (J6200, activity on this pin indicates the GPS is operating)

GPS RF test points

The GPS antenna test pads are located on the top side as shown in figure "GPS antenna test pads". Checking for a connection between these two test points will confirm that the antenna is working correctly, as will performing a radiated CW test.

J6280 = GPS Ant

J6281 = GPS Ant Gnd

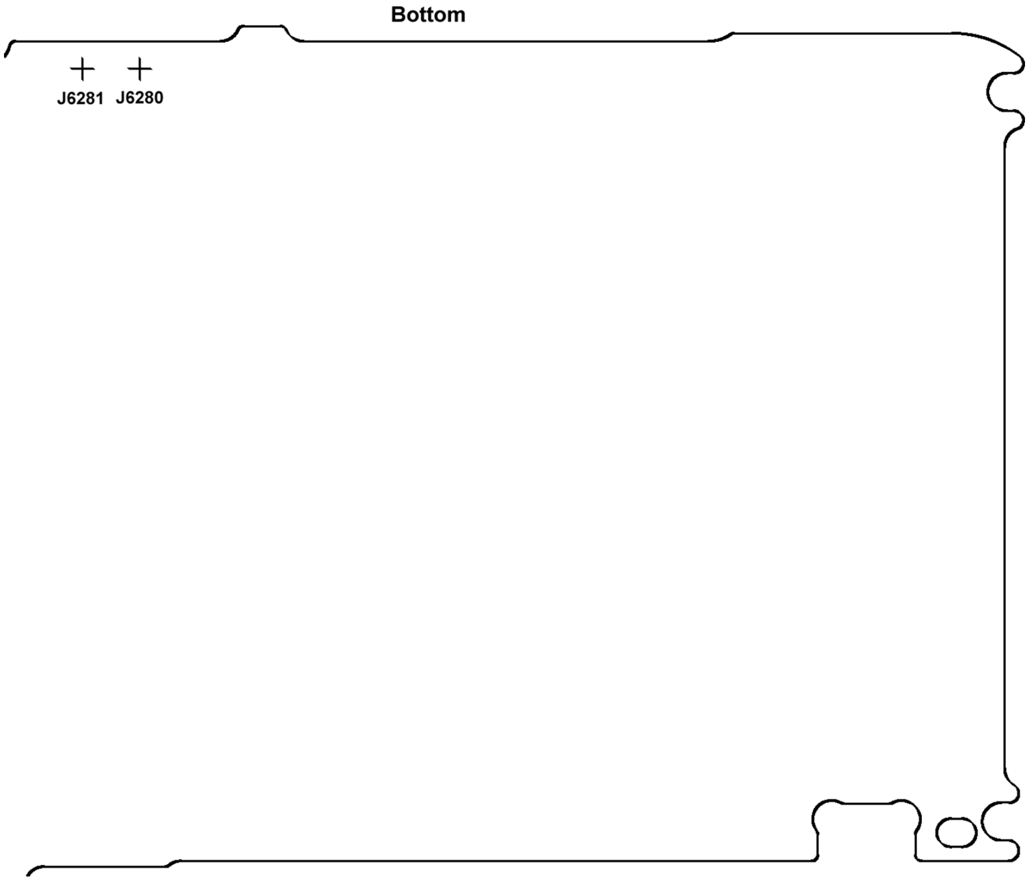


Figure 21 GPS antenna test pads

In order to probe GPS RF test points, inject 1575.52 MHz tone @ -50dBm at the GPS antenna test connector and select **Receiver On**, then probe the GPS RF test points as shown in the figure below. Compare RF levels with a known reference phone.

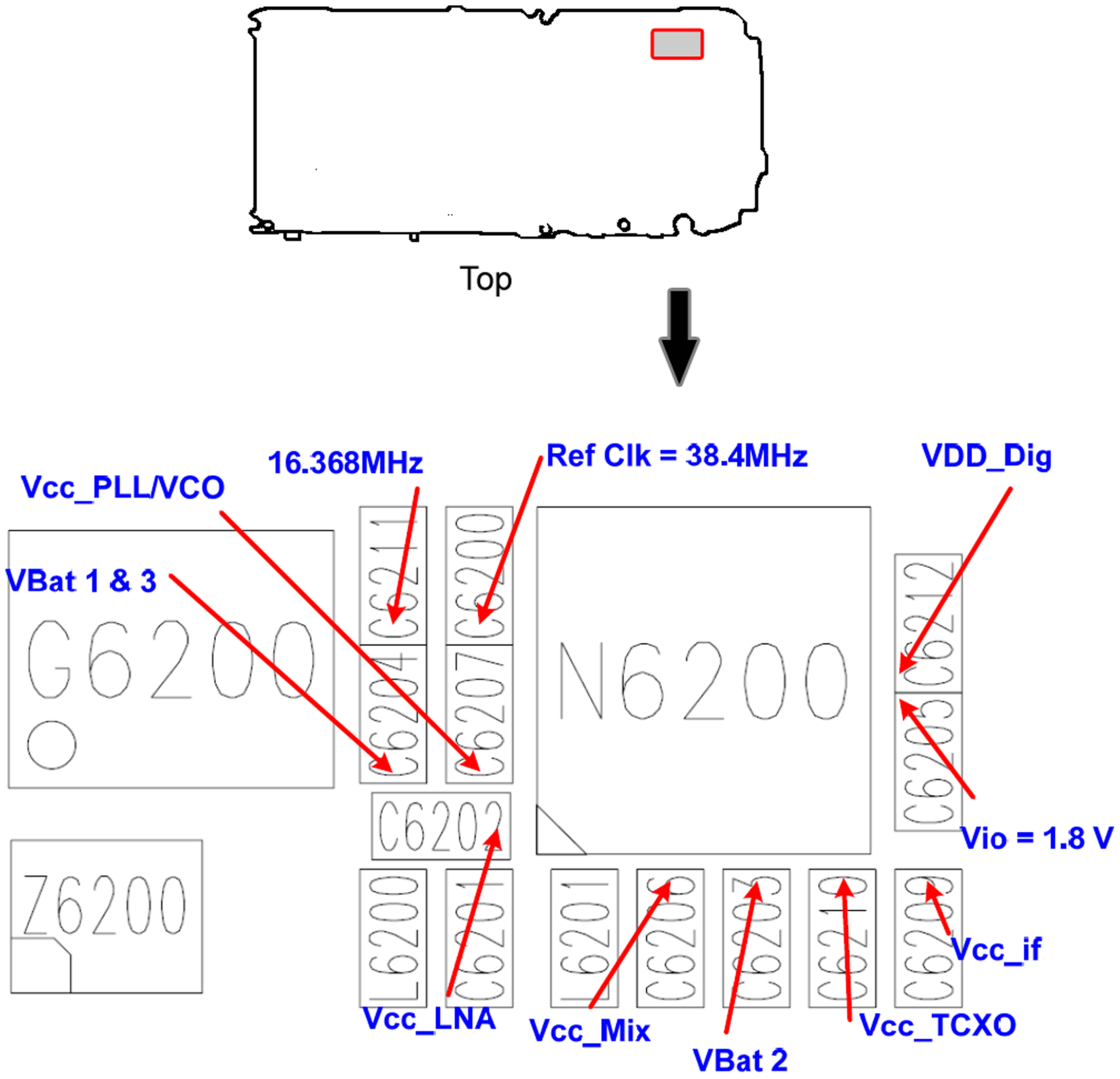

Top
16.368MHz
Ref Clk = 38.4MHz
VDD_Dig
Vcc_PLL/VCO
VBat 1 & 3
G6200
C6211
C6200
C6204
C6207
N6200
C6212
C6205
Vio = 1.8 V
C6202
Z6200
L6200
C6201
L6201
C6206
C6203
C6210
C6209
Vcc_if
Vcc_LNA
Vcc_Mix
VBat 2
Vcc_TCXO

Figure 22 GPS layout and basic test points

GPS settings for Phoenix

GPS control

Context

Use the following to test GPS using Phoenix.

Steps

1. Start Phoenix service software.
2. From the **File** menu, select **Scan Product** and check that the correct product version is displayed.

3. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.

   Select **Idle** to confirm the GPS is enabled and is in idle mode; at this point all clocks should be present, GPS_En_Reset should be high (1.8V), and Vdd_Dig (1.1V), Vcc_TCXO (2.5V) & Vcc_PLL/VCO (1.35V) should be present. Turning **Receiver Action** *On* will turn on all the RF sections of the ASIC and so all LDOs will be on.

   Note: These checks are part of GPS basic checks troubleshooting (page 3–51)

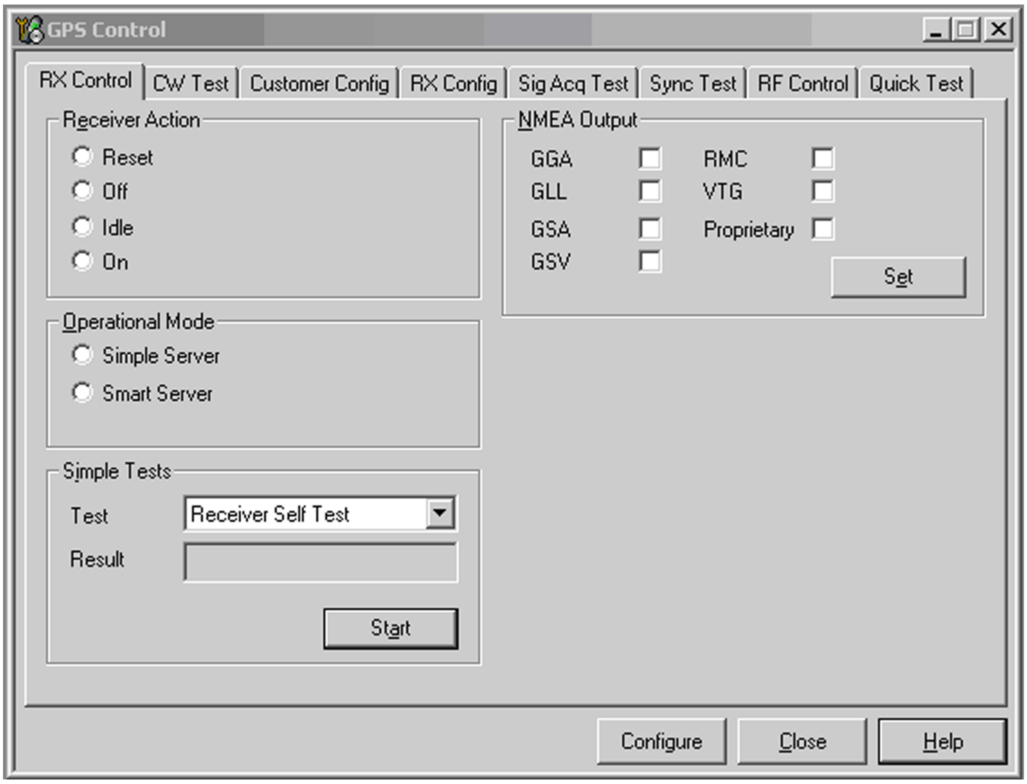

GPS Control
RX Control
CW Test
Customer Config
RX Config
Sig Acq Test
Sync Test
RF Control
Quick Test
Receiver Action
○ Reset
○ Off
○ Idle
○ On
NMEA Output
GGA ☐
RMC ☐
GLL ☐
VTG ☐
GSA ☐
Proprietary ☐
GSV ☐
Set
Operational Mode
○ Simple Server
○ Smart Server
Simple Tests
Test
Receiver Self Test
Result
Start
Configure
Close
Help

Figure 23 GPS Control dialog box

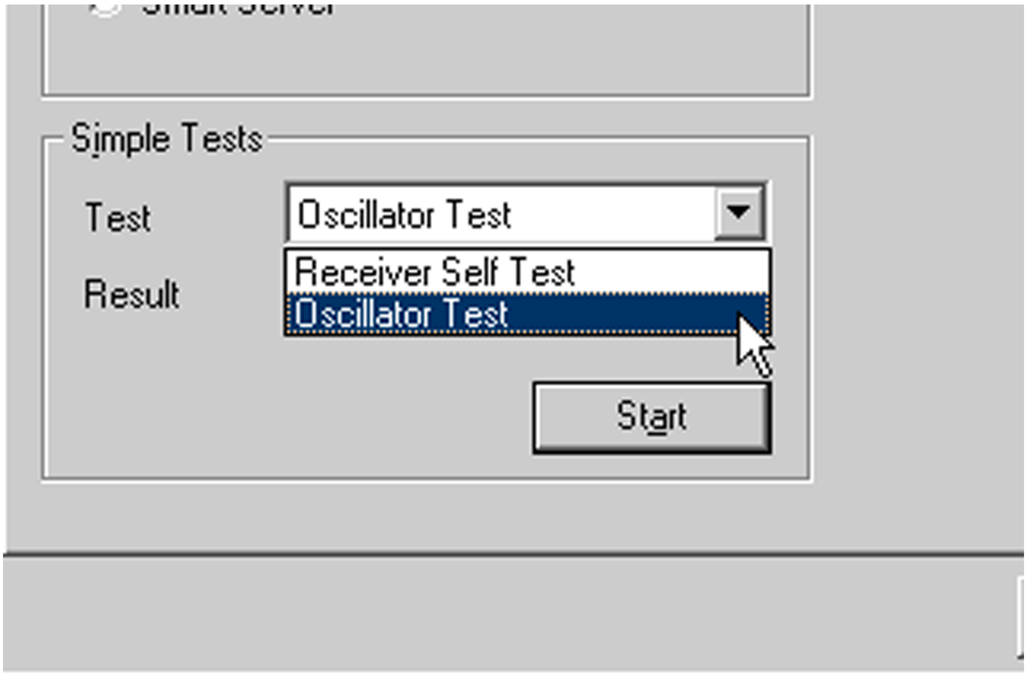

Simple Tests
Test
Oscillator Test
Receiver Self Test
Oscillator Test
Result
Start

Figure 24 Simple Tests – Oscillator Test & Receiver Self Test

Oscillator test

Context

The 16.368 MHz GPS Clk is compared against the CE Ref Clk and the output is the GPS Clk offset.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *Rx Control* window, go to the **Simple Tests** section, select **Oscillator Test** and click **Start**. The Offset result will be returned and should be within the limits of +- 84Hz.

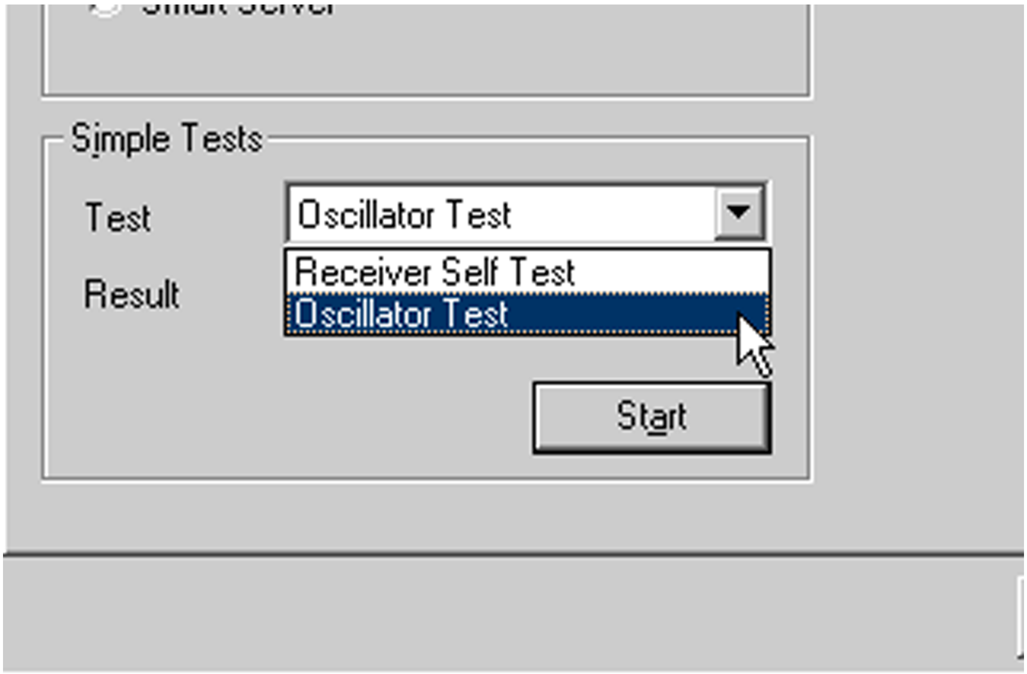


Figure 25 Simple Tests – Oscillator Test

Receiver self test

Context

Receiver self test can be used to check the correct functionality of the receiver core. For the test, GPS software configures internal test source to generate synthetic GPS-like data, processing it in the baseband and writing the results into the channel processor memory. The test compares the data in the channel memory against the expected value and reports a PASS/FAIL status.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *Rx Control* window, go to the **Simple Tests** section, select **Receiver Self Test** and click **Start**. The test returns a PASS/FAIL result.

   > **Note:** The Oscillator Test should not be run after the Receiver Self Test. This sequence of tests may cause the Oscillator test to prolong and result in Phoenix timing out. If you are carrying out both of these tests, run the Oscillator Test first, after which you can run the Receiver Self Test.

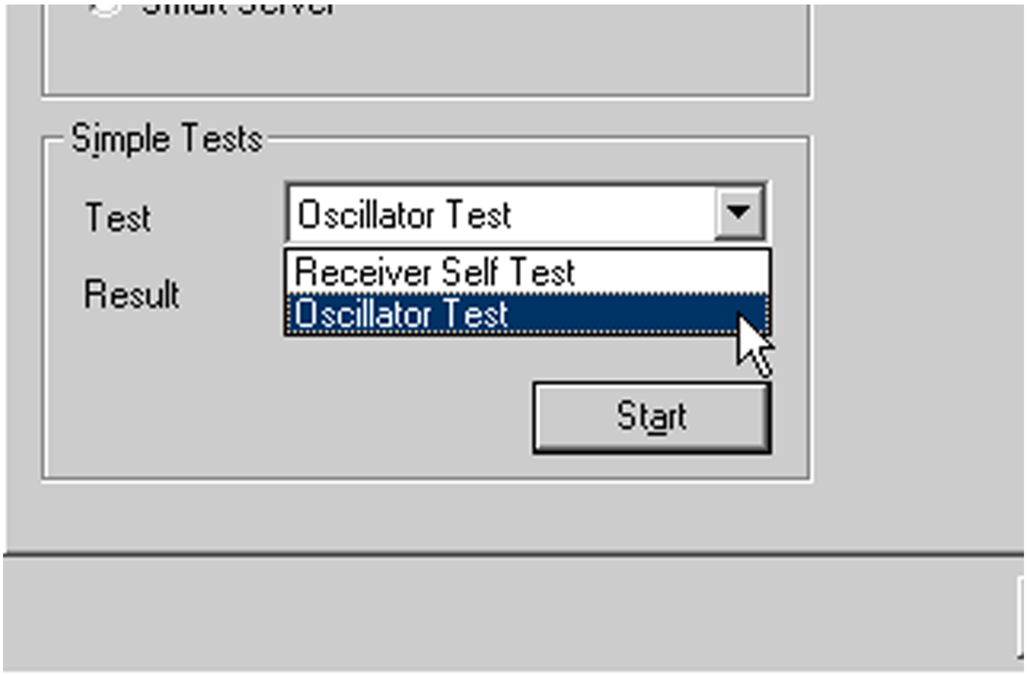

Simple Tests
Test
Oscillator Test
Receiver Self Test
Oscillator Test
Result
Start

Figure 26 Simple Tests – Receiver Self Test

CW Test

Context

This test reports the SNR of a CW signal input to the GPS antenna port.

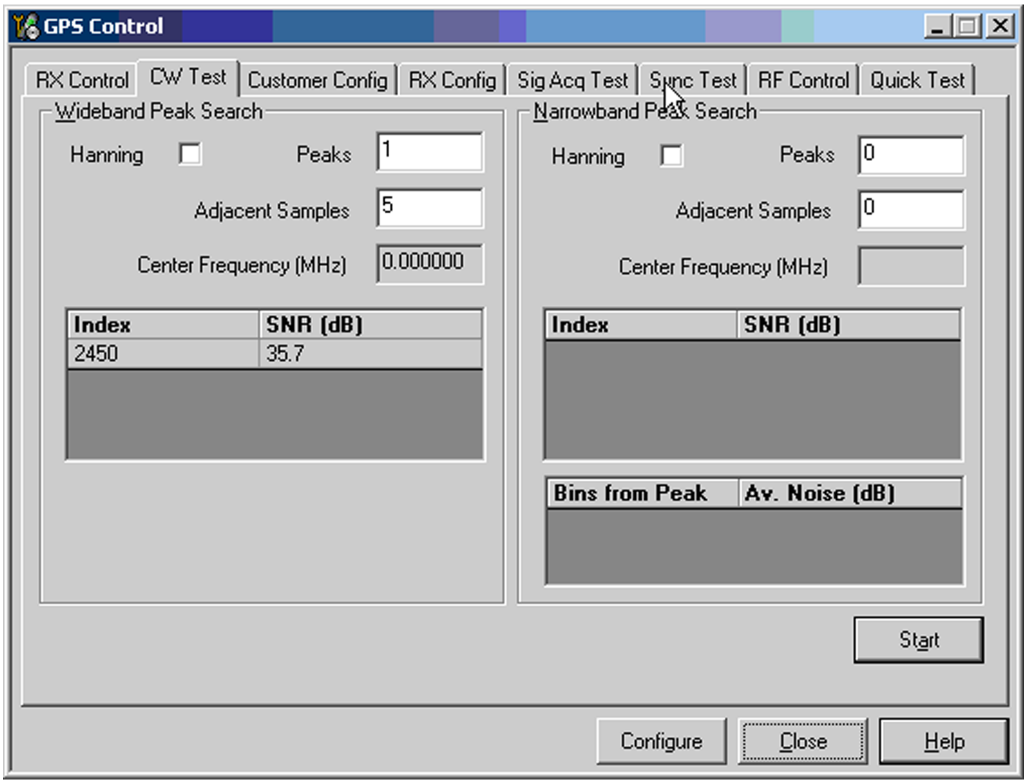
Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *CW Test* window, ensure the input settings are as shown in the figure below. Inject 1575.52 MHz tone at the GPS antenna test connector at a level of -110dBm and click **Start**.

   For Pin = -110dBm and negligible other losses, the expected result ranges are:

   - Galvanic 29.8dB to 38.1dB
   - Radiated 25.8dB to 38.1dB


GPS Control
RX Control
CW Test
Customer Config
RX Config
Sig Acq Test
Sync Test
RF Control
Quick Test
Start
Configure
Close
Help

Wideband Peak Search

Hanning ☐

Peaks: 1

Adjacent Samples: 5

Center Frequency (MHz): 0.000000

Index	SNR (dB)
2450	35.7

Narrowband Peak Search

Hanning ☐

Peaks: 0

Adjacent Samples: 0

Center Frequency (MHz):

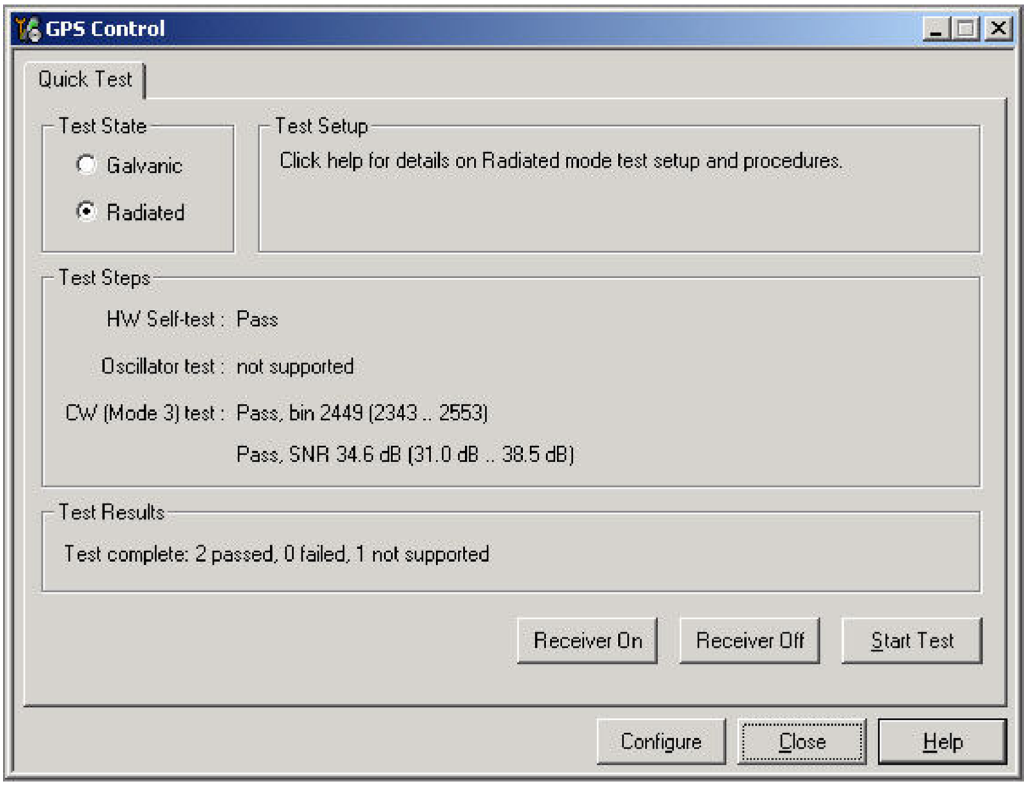
Index	SNR (dB)

Bins from Peak	Av. Noise (dB)

Figure 27 CW Test window

Quick Test window

Because the *Quick Test* runs the *Receiver Self Test* before the *Oscillator Test*, it may cause a timeout on the *Oscillator Test*. It does not necessarily mean that Oscillator Test has failed, but carrying out the Oscillator Test (page 3–46), Receiver Self Test (page 3–47) and CW Test (page 3–48) individually will give more valid results.



GPS Control
Quick Test
Receiver On
Receiver Off
Start Test
Configure
Close
Help

Test State

○ Galvanic

● Radiated

Test Setup

Click help for details on Radiated mode test setup and procedures.

Test Steps

HW Self-test : Pass

Oscillator test : not supported

CW (Mode 3) test : Pass, bin 2449 (2343 .. 2553)

Pass, SNR 34.6 dB (31.0 dB .. 38.5 dB)

Test Results

Test complete: 2 passed, 0 failed, 1 not supported

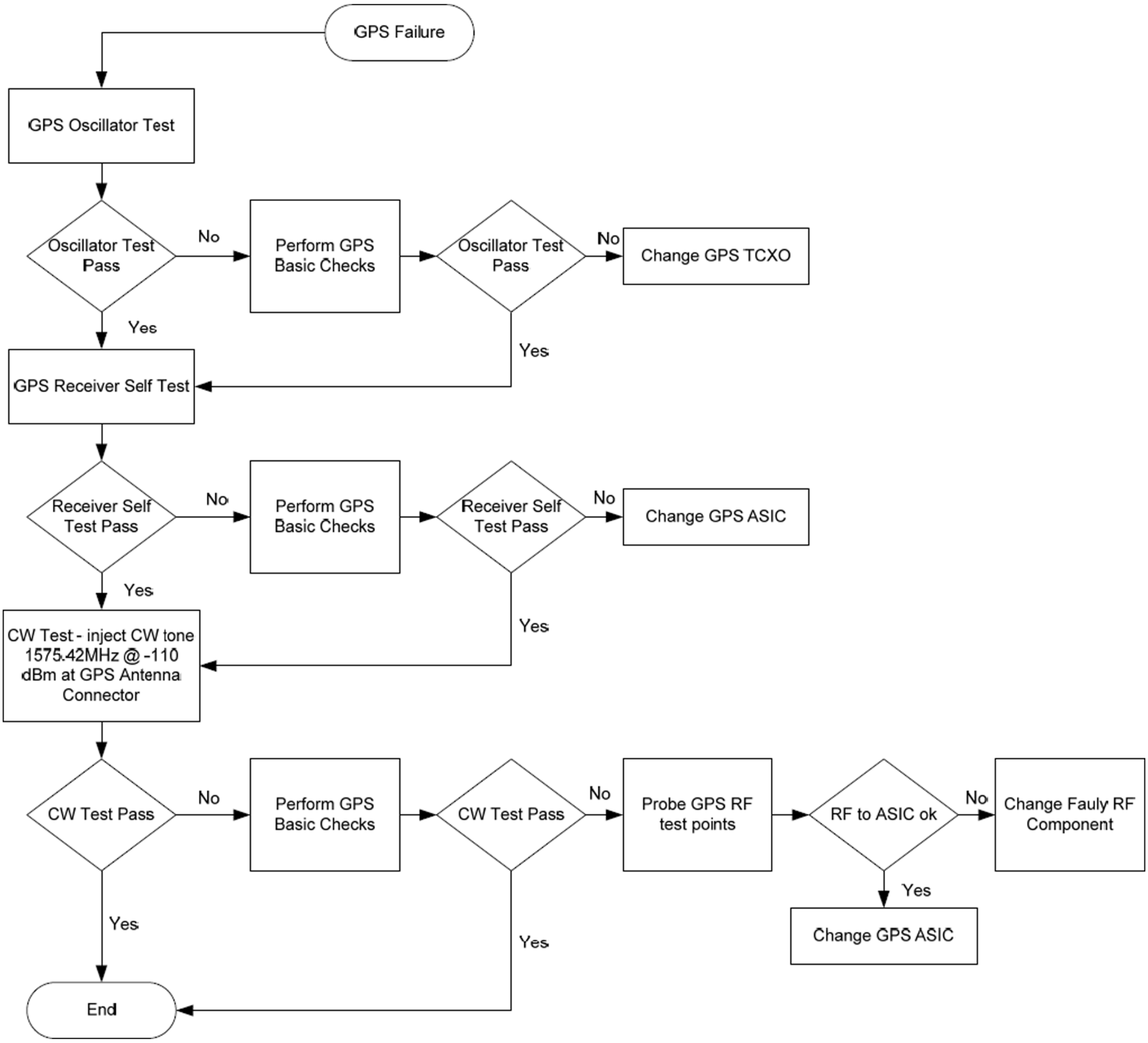
Figure 28 GPS Quick Test window for GPS troubleshooting

GPS failure troubleshooting

Context

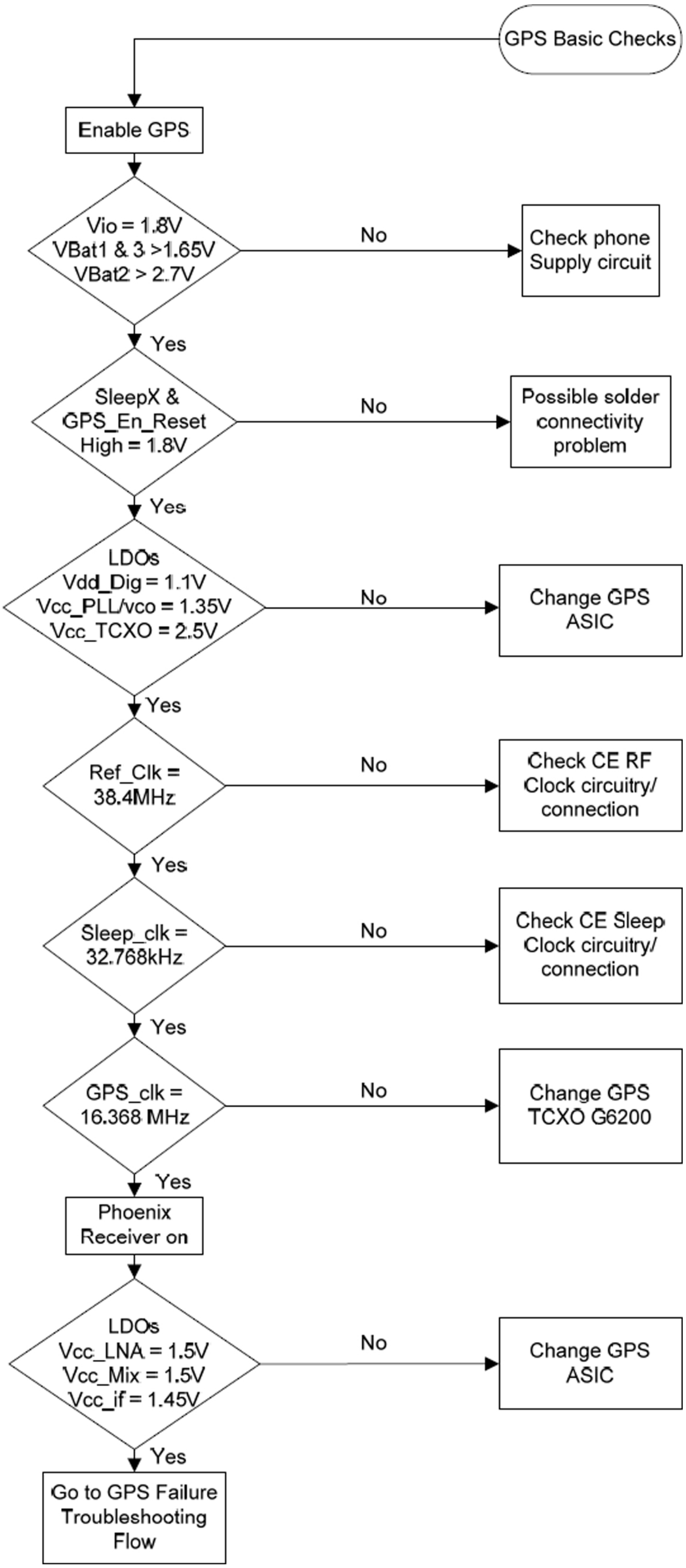
GPS troubleshooting is broken down into two parts: General GPS failure & GPS basic checks. The GPS failure troubleshooting flow can be followed and, where applicable, will feed into the basic checks troubleshooting flow.

Troubleshooting flow


GPS Failure
GPS Oscillator Test
Oscillator Test Pass
No
Perform GPS Basic Checks
Oscillator Test Pass
No
Change GPS TCXO
Yes
Yes
GPS Receiver Self Test
Receiver Self Test Pass
No
Perform GPS Basic Checks
Receiver Self Test Pass
No
Change GPS ASIC
Yes
Yes
CW Test - inject CW tone 1575.42MHz @ -110 dBm at GPS Antenna Connector
CW Test Pass
No
Perform GPS Basic Checks
CW Test Pass
No
Probe GPS RF test points
RF to ASIC ok
No
Change Fauly RF Component
Yes
Change GPS ASIC
Yes
Yes
End

GPS basic checks troubleshooting

Troubleshooting flow


GPS Basic Checks
Enable GPS
Vio = 1.8V
VBat1 & 3 >1.65V
VBat2 > 2.7V
No
Check phone Supply circuit
Yes
SleepX & GPS_En_Reset High = 1.8V
No
Possible solder connectivity problem
Yes
LDOs
Vdd_Dig = 1.1V
Vcc_PLL/vco = 1.35V
Vcc_TCXO = 2.5V
No
Change GPS ASIC
Yes
Ref_Clk = 38.4MHz
No
Check CE RF Clock circuitry/ connection
Yes
Sleep_clk = 32.768kHz
No
Check CE Sleep Clock circuitry/ connection
Yes
GPS_clk = 16.368 MHz
No
Change GPS TCXO G6200
Yes
Phoenix Receiver on
LDOs
Vcc_LNA = 1.5V
Vcc_Mix = 1.5V
Vcc_if = 1.45V
No
Change GPS ASIC
Yes
Go to GPS Failure Troubleshooting Flow

Bluetooth and FM radio

Bluetooth and FM radio introduction

The Bluetooth and FM radio are combined in the same ASIC, so both features are checked when troubleshooting. The following problems can occur with the Bluetooth and FM radio hardware:

Symptom	Problem	Repair solution
Unable to switch on Bluetooth on phone user interface.	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs or SMD components.	Replacement of Bluetooth/FM ASIC/module.
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset.	Open circuit solder joints or component failure of BTH/FM ASIC/module BB ASICs (PCM interface).	Replacement of Bluetooth/FM ASIC/module.
Able to turn on Bluetooth on phone user interface, but unable to detect other Bluetooth devices.	Open circuit solder joints or detacted component in Bluetooth antenna circuit.	Repair of Bluetooth antenna circuit.
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with FM headset inserted.	Open circuit solder joints or detached component in FM antenna circuit.	Repair of FM antenna circuit.
Able to perform scans to detect local FM radio stations with functional FM headset inserted, but unable to hear FM audio through headset.	Open circuit solder joints or detached component in FM audio path between Bluetooth/FM ASIC and headset.	Repair of FM audio circuit.

Bluetooth and FM radio component placement

The figure below shows the key component placement for BTHFMRDS2.1M in RM-356.

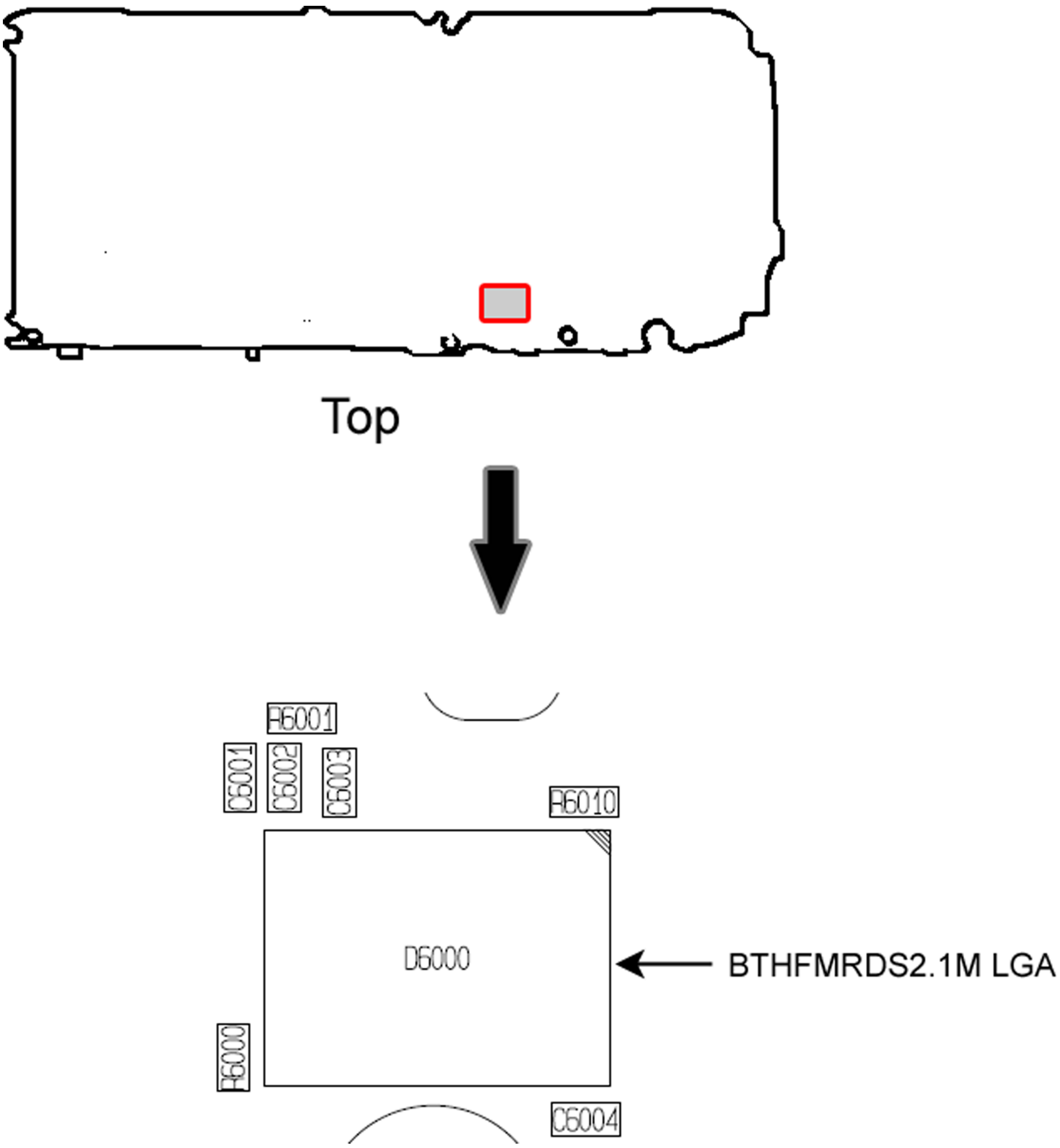

Top
R6001
C6001
C6002
C6003
R6010
D6000
BTHFMRDS2.1M LGA
R6000
C6004

Figure 29 Key component placement for BTHFMRDS2.1M

The shared Bluetooth/WLAN antenna is attached to the side of the B-cover, and the Bluetooth RF signal is routed through a WLAN front-end module.

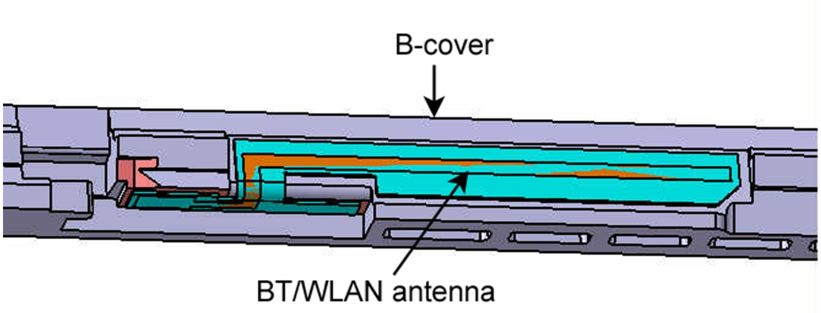

B-cover
BT/WLAN antenna

Figure 30 BT/WLAN antenna

The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

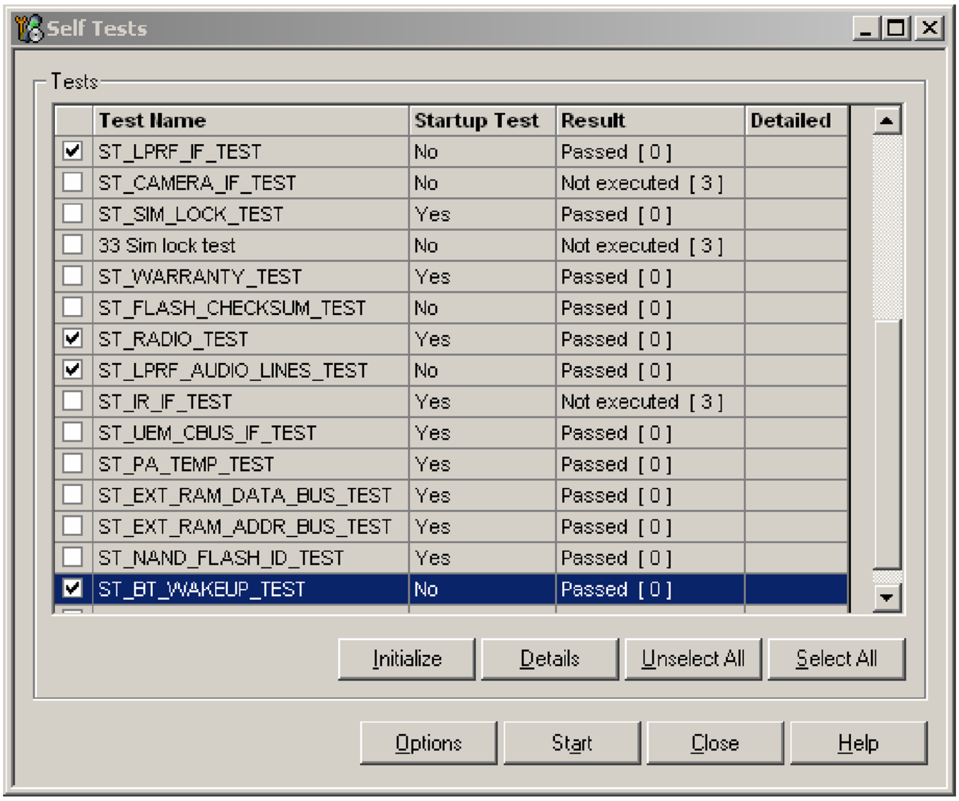
Bluetooth and FM Radio Self Tests

Context

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose File → Scan Product.
4. From the Mode drop-down menu, set to Local.
5. Choose Testing → Self Tests.
6. In the Self Tests window check the following Bluetooth and FM Radio tests:
    - ST_LPRF_IF_TEST
    - ST_LPRF_AUDIO_LINES_TEST
    - ST_BT_WAKEUP_TEST
    - ST_RADIO_TEST
7. To run the test, click Start



	Test Name	Startup Test	Result	Detailed
☑	ST_LPRF_IF_TEST	No	Passed [0]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Passed [0]	
☐	33 Sim lock test	No	Not executed [3]	
☐	ST_WARRANTY_TEST	Yes	Passed [0]	
☐	ST_FLASH_CHECKSUM_TEST	No	Passed [0]	
☑	ST_RADIO_TEST	Yes	Passed [0]	
☑	ST_LPRF_AUDIO_LINES_TEST	No	Passed [0]	
☐	ST_IR_IF_TEST	Yes	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_PA_TEMP_TEST	Yes	Passed [0]	
☐	ST_EXT_RAM_DATA_BUS_TEST	Yes	Passed [0]	
☐	ST_EXT_RAM_ADDR_BUS_TEST	Yes	Passed [0]	
☐	ST_NAND_FLASH_ID_TEST	Yes	Passed [0]	
☑	ST_BT_WAKEUP_TEST	No	Passed [0]	

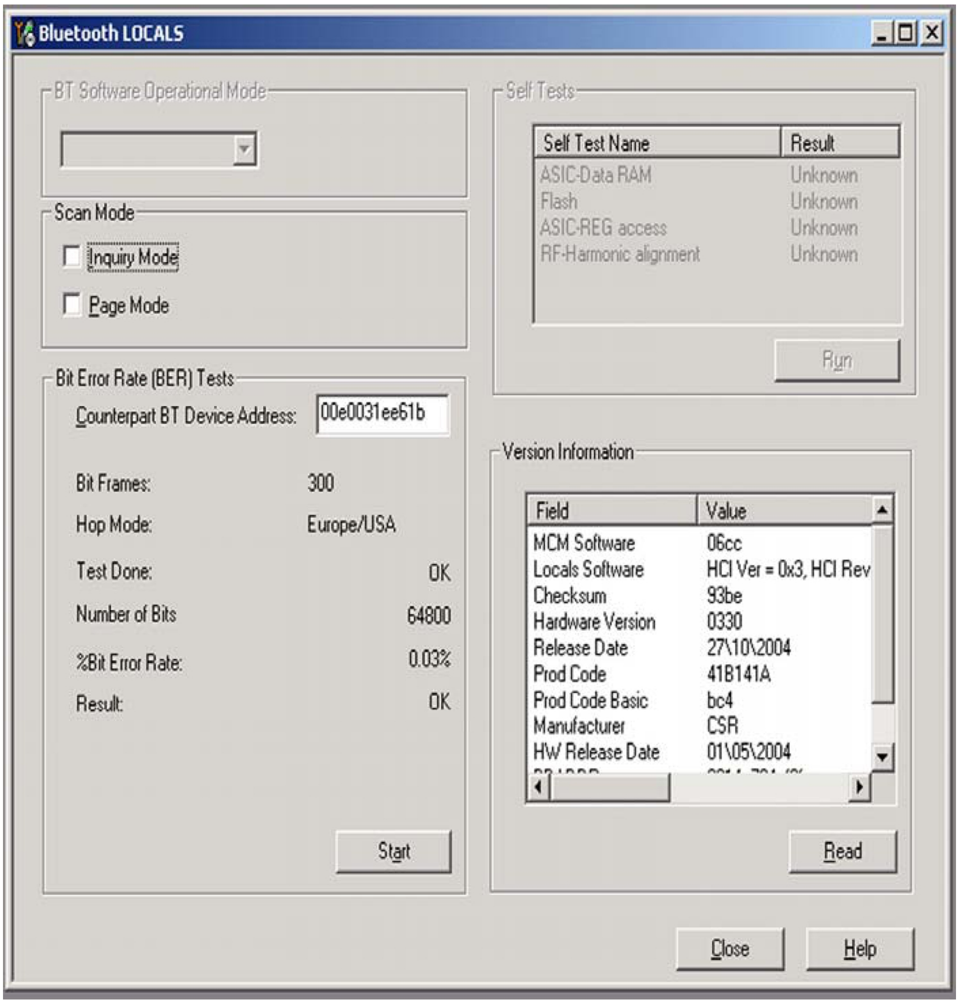
Bluetooth BER test

Context

JBT-9 or SB-6 Bluetooth test box (BT box) is required to perform a BER test. If a BT box is not available, Bluetooth functionality can be checked by transferring a file to another Bluetooth phone.

Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose **File** → **Scan Product**.
4. Choose **Testing** → **Bluetooth LOCALS**
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the JBT-3, JBT-6, JBT-9, or SB-6 Bluetooth test box.
6. In the Bluetooth LOCALS window, write the 12-digit serial number on the **Counterpart BT Device Address** line.
7. Place the BT-box near (within 10 cm) of the phone and click **Run BER Test**.


Bluetooth LOCALS
BT Software Operational Mode
Scan Mode
☐ Inquiry Mode
☐ Page Mode
Bit Error Rate (BER) Tests
Start
Self Tests
Run
Version Information
Read
Close
Help

Counterpart BT Device Address: 00e0031ee61b

Bit Frames: 300

Hop Mode: Europe/USA

Test Done: OK

Number of Bits: 64800

%Bit Error Rate: 0.03%

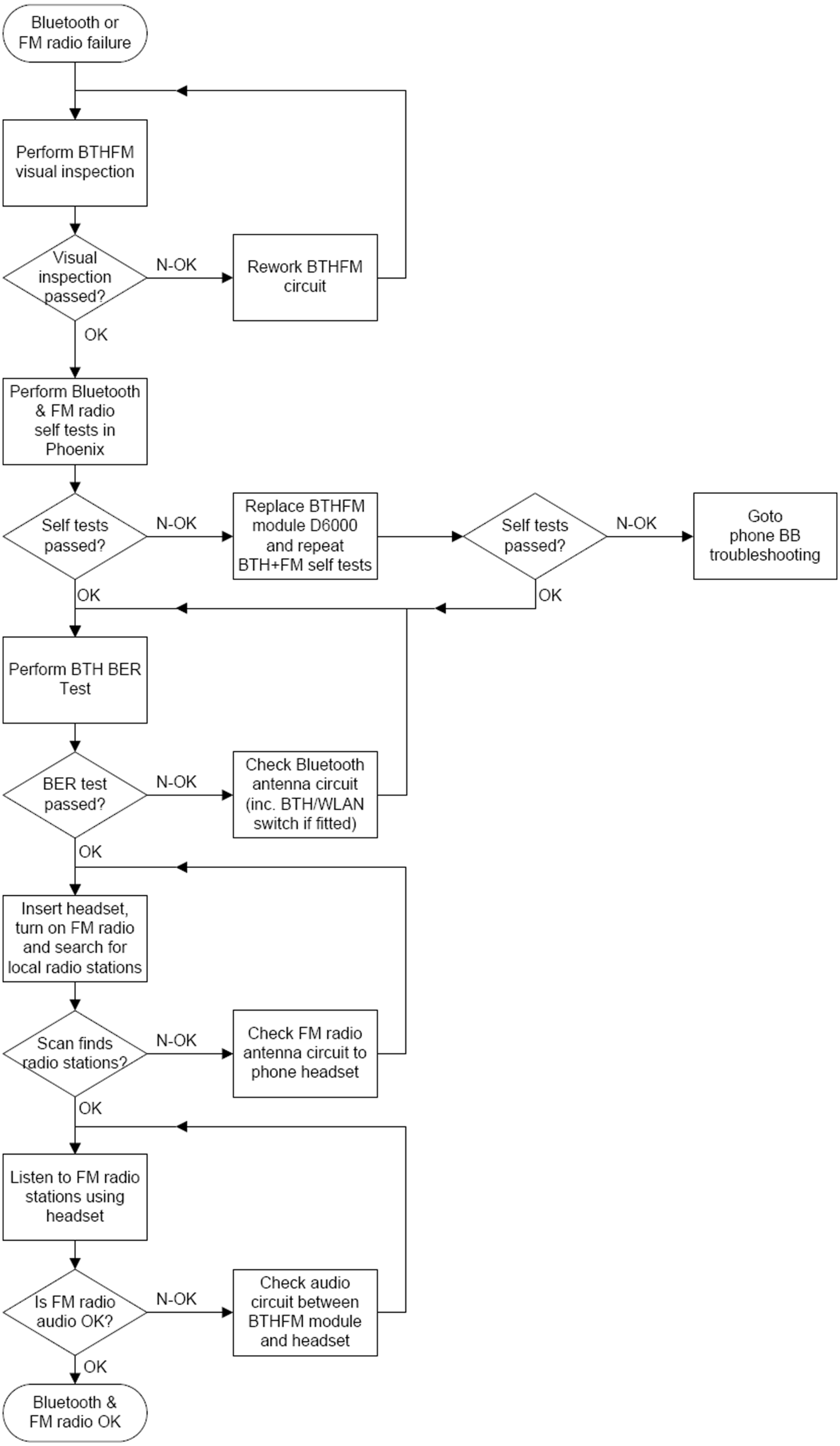
Result: OK

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Rev
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR
HW Release Date	01\05\2004

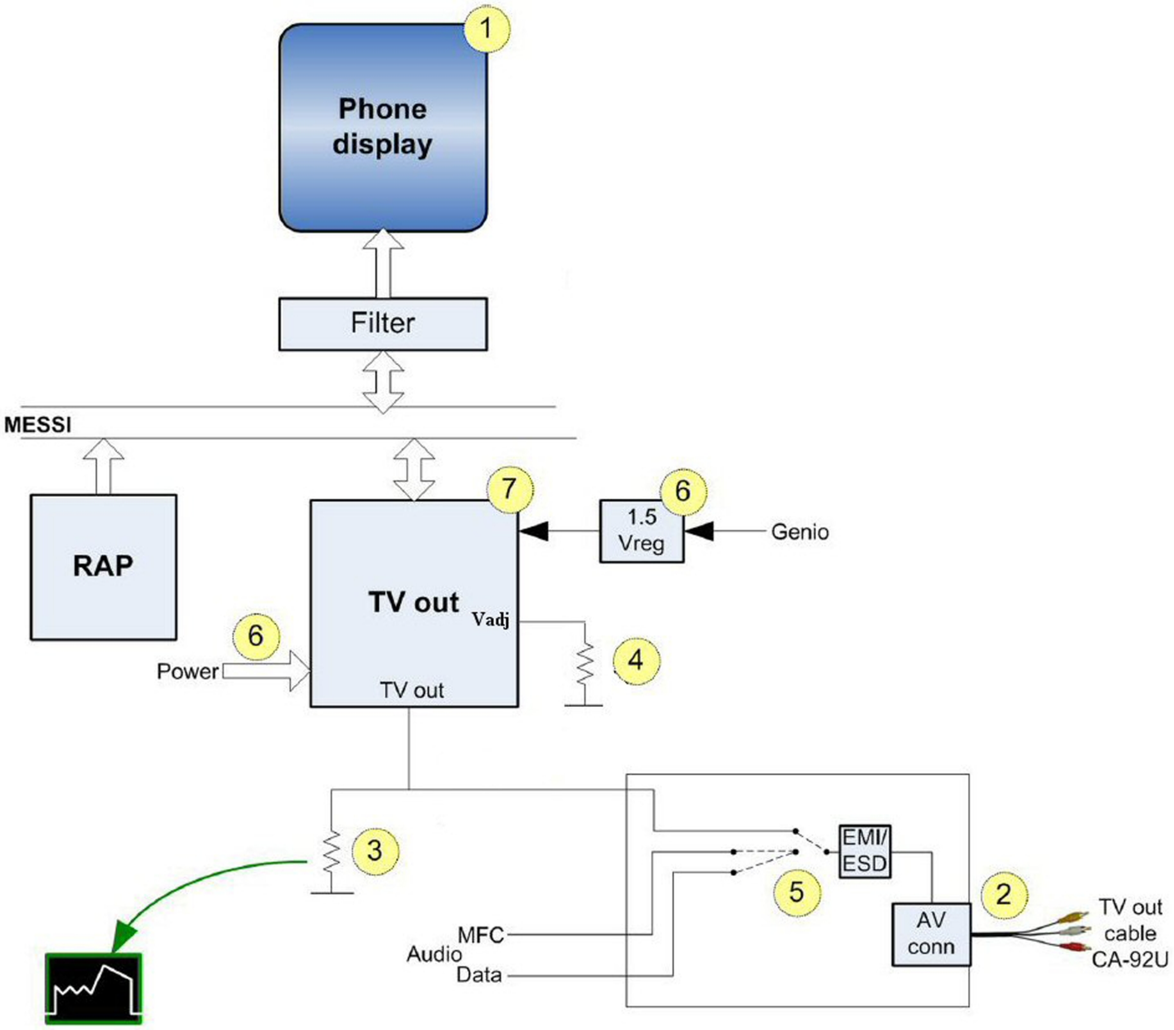
Bluetooth and FM radio module troubleshooting

Troubleshooting flow


Bluetooth or FM radio failure
Perform BTHFM visual inspection
Visual inspection passed?
N-OK
Rework BTHFM circuit
OK
Perform Bluetooth & FM radio self tests in Phoenix
Self tests passed?
N-OK
Replace BTHFM module D6000 and repeat BTH+FM self tests
Self tests passed?
N-OK
Goto phone BB troubleshooting
OK
OK
Perform BTH BER Test
BER test passed?
N-OK
Check Bluetooth antenna circuit (inc. BTH/WLAN switch if fitted)
OK
Insert headset, turn on FM radio and search for local radio stations
Scan finds radio stations?
N-OK
Check FM radio antenna circuit to phone headset
OK
Listen to FM radio stations using headset
Is FM radio audio OK?
N-OK
Check audio circuit between BTHFM module and headset
OK
Bluetooth & FM radio OK

TV out troubleshooting

Troubleshooting flow


1
Phone display
Filter
MESSI
RAP
7
6
1.5 Vreg
Genio
TV out
Vadj
6
Power
TV out
4
3
5
EMI/ ESD
2
AV conn
TV out cable CA-92U
MFC
Audio
Data

Troubleshooting steps

1) Make sure that the phone display is working

2) Make sure that the TV out cable is plugged into both phone and TV set. If no image is shown on TV, make sure it is selected in phone SW; *Settings > Enhancements > TV cable > Activate TV out (activate appropriate TV standard)*

3) Check TV out signal **(R2493)**

4) Check **R2494, R2495.** Also check **R2480.**

5) Check switch EMI/EDS + AV connector (**C2137, N2122, L2010, X2010, [R2013 NA])**

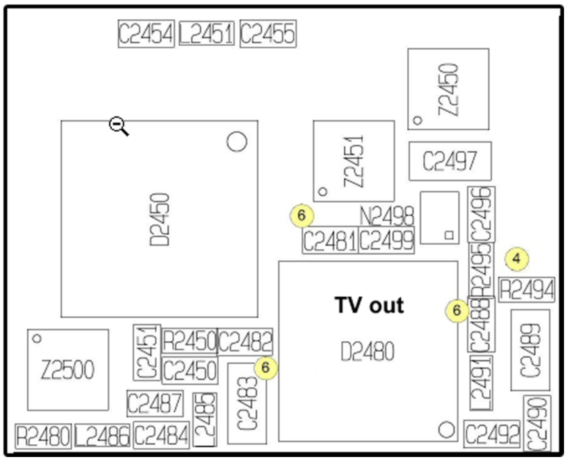
6) Verify voltage on these capacitors:

- **C2482** (IO) = 1.72 V - 1.92 V
- **C2481** (Core) = 1.44 V - 1.56 V
- **C2483** (VPLL) = 1.44 V - 1.56 V
- **C2488** (VDAC) = 2.66 V - 2.86 V

7) Replace TV out ASIC (**D2480**)

8) Retest after each repair/replaced part

Testpoints


C2454
L2451
C2455
Z2450
D2450
Z2451
C2497
6
N2498
C2481
C2499
C2496
4
R2495
R2494
TV out
D2480
6
C2488
C2489
Z2500
C2451
R2450
C2482
C2450
6
C2491
C2487
C2485
C2483
R2480
L2486
C2484
C2492
C2490

Audio troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- HP microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	HS_MIC & GND	HS_EAR_L & GND	-8.6	1000	367	1.2	NA
		HS_EAR_R & GND					
External Mic to Internal Earpiece	HS_MIC & GND	EarP & GND	-10	1000	310	1.2	NA
		EarN & GND					
External Mic to Internal handsfree	HS_MIC & GND	J2100	-6	1000			
		J2101					
Digital Mic to External Earpiece	Acoustical input, 1kHz sine wave	HS_EAR_L & GND	NA	94 dB SPL	100		NA
		HS_EAR_R & GND					

Measurement data

Earpiece signal

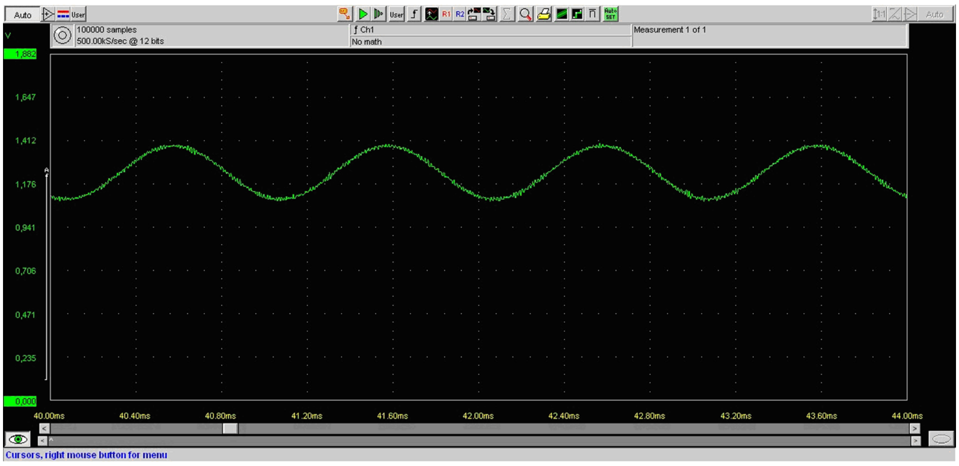

Auto
User
User
Auto
100000 samples
500.00kS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1
V
1,882
1,647
1,412
1,176
0,941
0,706
0,471
0,235
0,000
40.00ms
40.40ms
40.80ms
41.20ms
41.60ms
42.00ms
42.40ms
42.80ms
43.20ms
43.60ms
44.00ms
Cursors, right mouse button for menu

Figure 31 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

Integrated handsfree signal

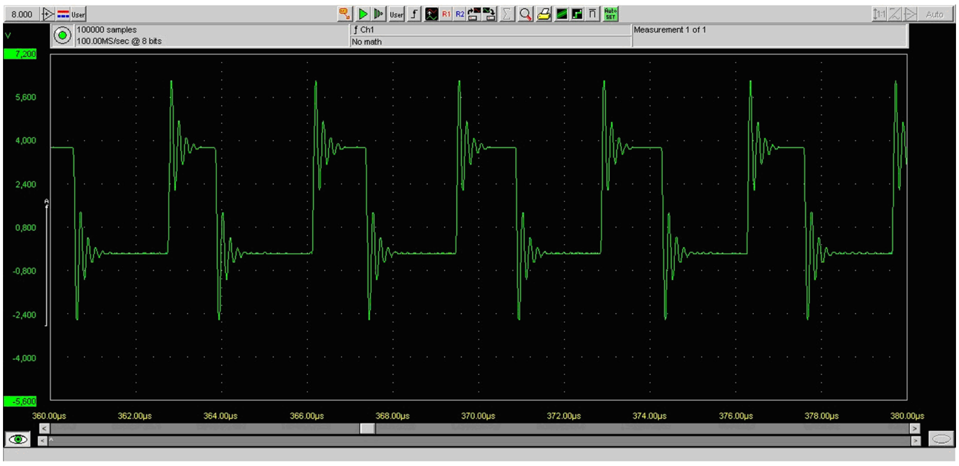


Figure 32 Single-ended output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected (measured at speaker pads). No filter is used.

External output from AV

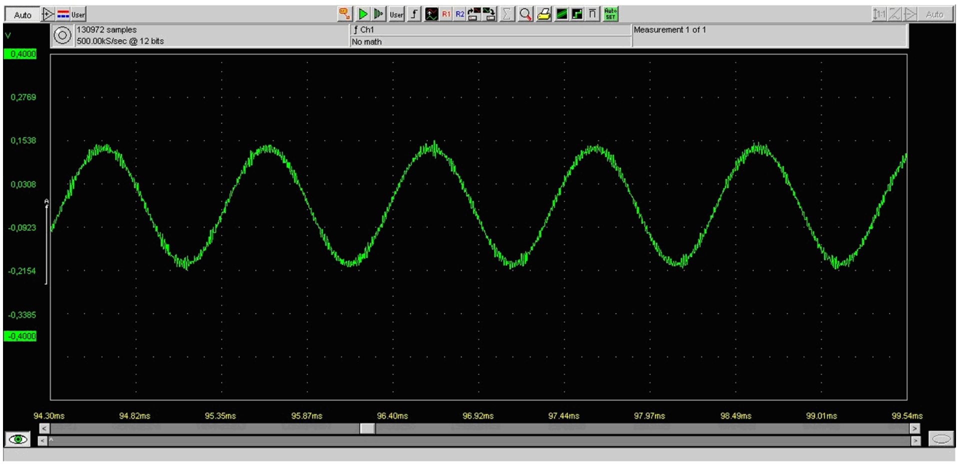


Figure 33 Single-ended output waveform of the Ext_in_Ext_out loop.

External output from AV (acoustic input)

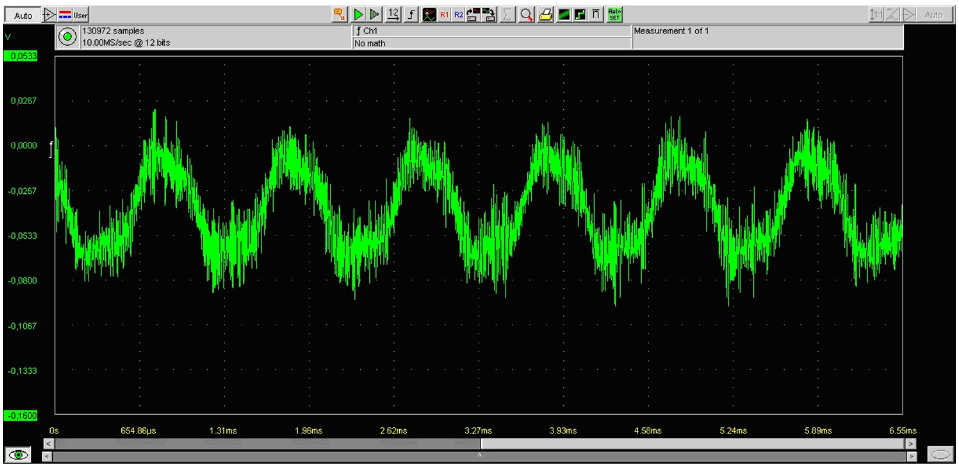
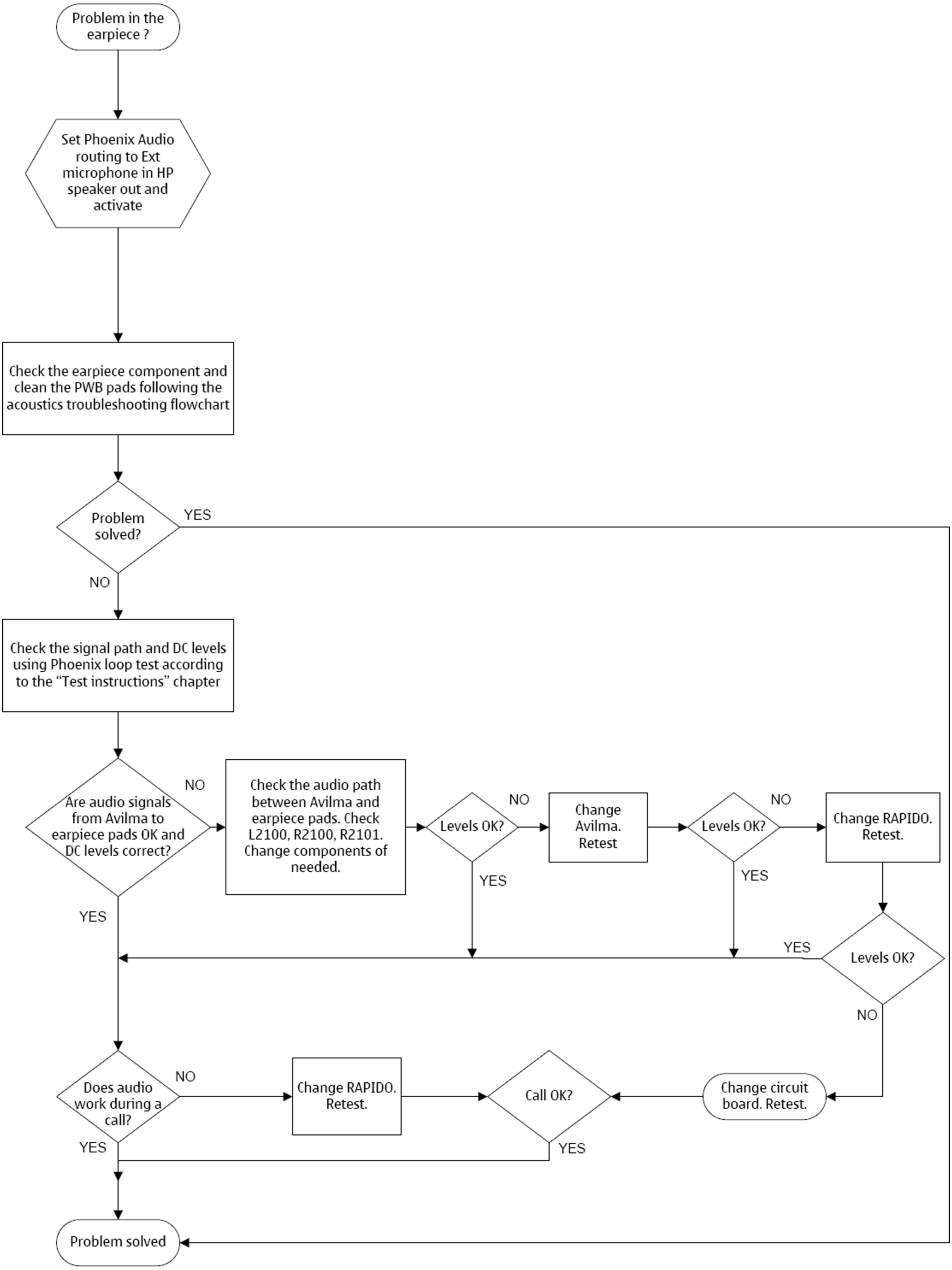


Figure 34 Single-ended output waveform of the HP_microphone_in_Ext_out loop.

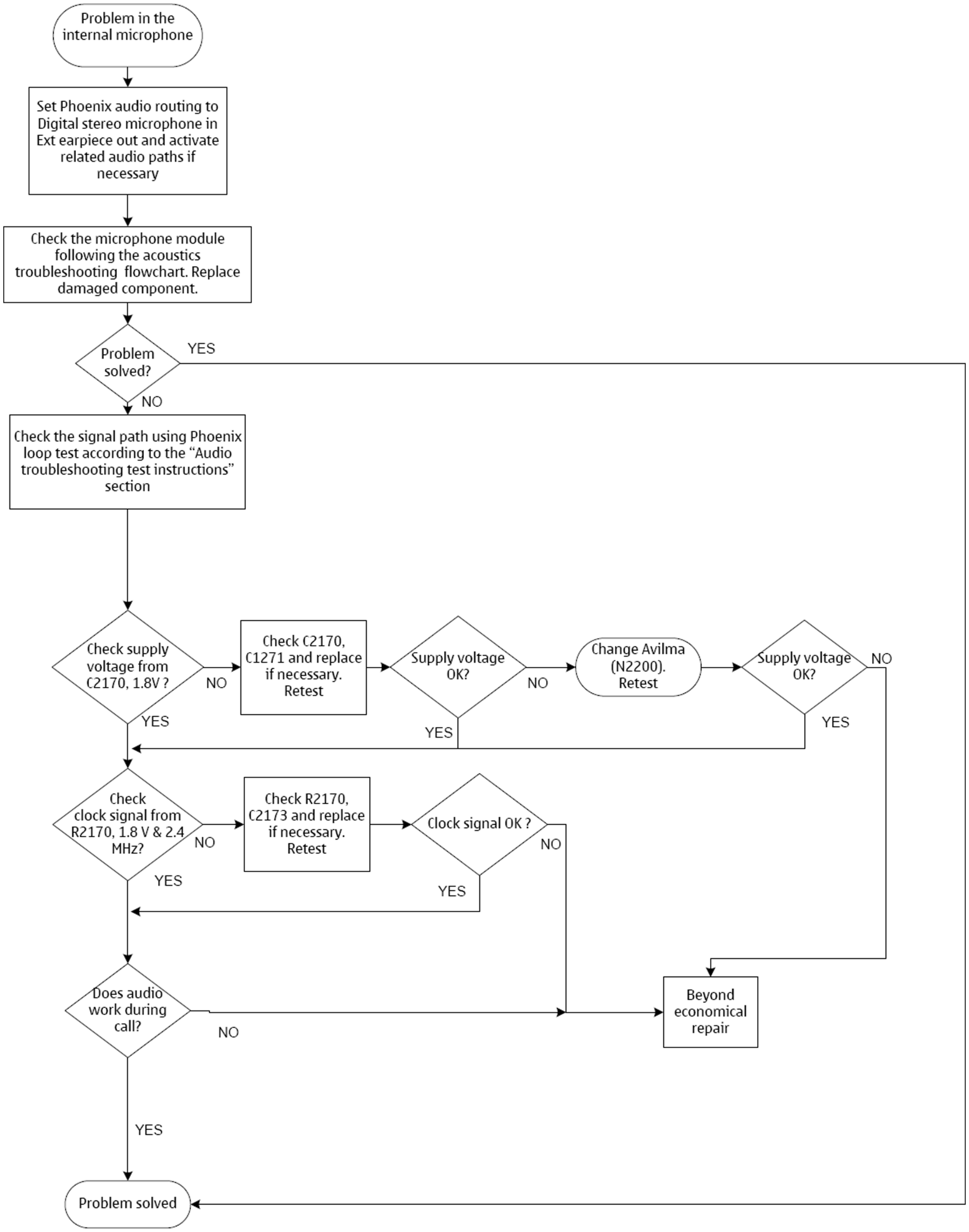
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece ?
Set Phoenix Audio routing to Ext microphone in HP speaker out and activate
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Test instructions" chapter
Are audio signals from Avilma to earpiece pads OK and DC levels correct?
NO
YES
Check the audio path between Avilma and earpiece pads. Check L2100, R2100, R2101. Change components of needed.
Levels OK?
NO
YES
Change Avilma. Retest
Levels OK?
NO
YES
Change RAPIDO. Retest.
Levels OK?
YES
NO
Does audio work during a call?
NO
YES
Change RAPIDO. Retest.
Call OK?
YES
Change circuit board. Retest.
Problem solved

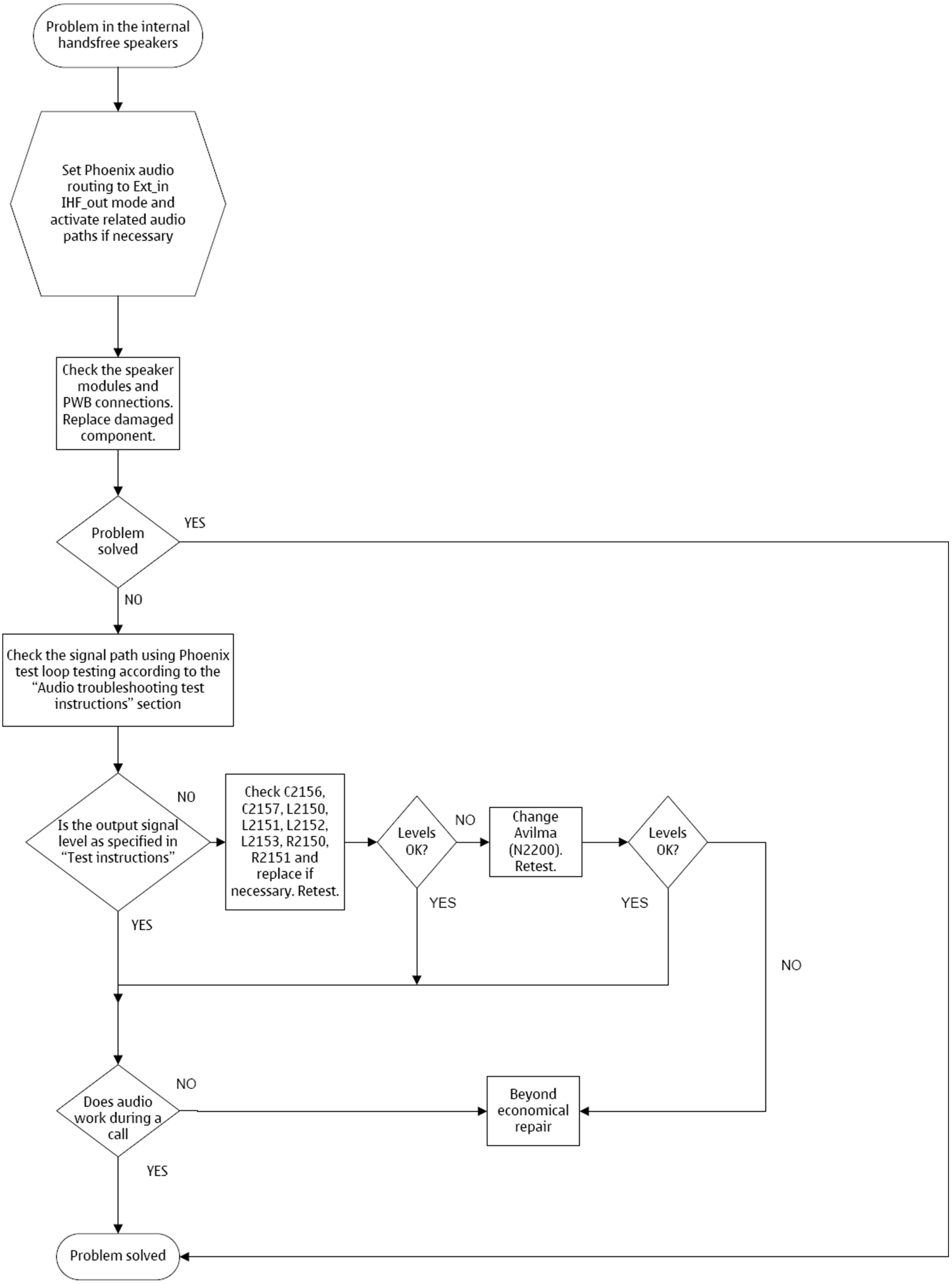
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone
Set Phoenix audio routing to Digital stereo microphone in Ext earpiece out and activate related audio paths if necessary
Check the microphone module following the acoustics troubleshooting flowchart. Replace damaged component.
Problem solved?
YES
NO
Check the signal path using Phoenix loop test according to the "Audio troubleshooting test instructions" section
Check supply voltage from C2170, 1.8V ?
NO
YES
Check C2170, C1271 and replace if necessary. Retest
Supply voltage OK?
NO
YES
Change Avilma (N2200). Retest
Supply voltage OK?
NO
YES
Check clock signal from R2170, 1.8 V & 2.4 MHz?
NO
YES
Check R2170, C2173 and replace if necessary. Retest
Clock signal OK ?
NO
YES
Does audio work during call?
NO
YES
Beyond economical repair
Problem solved

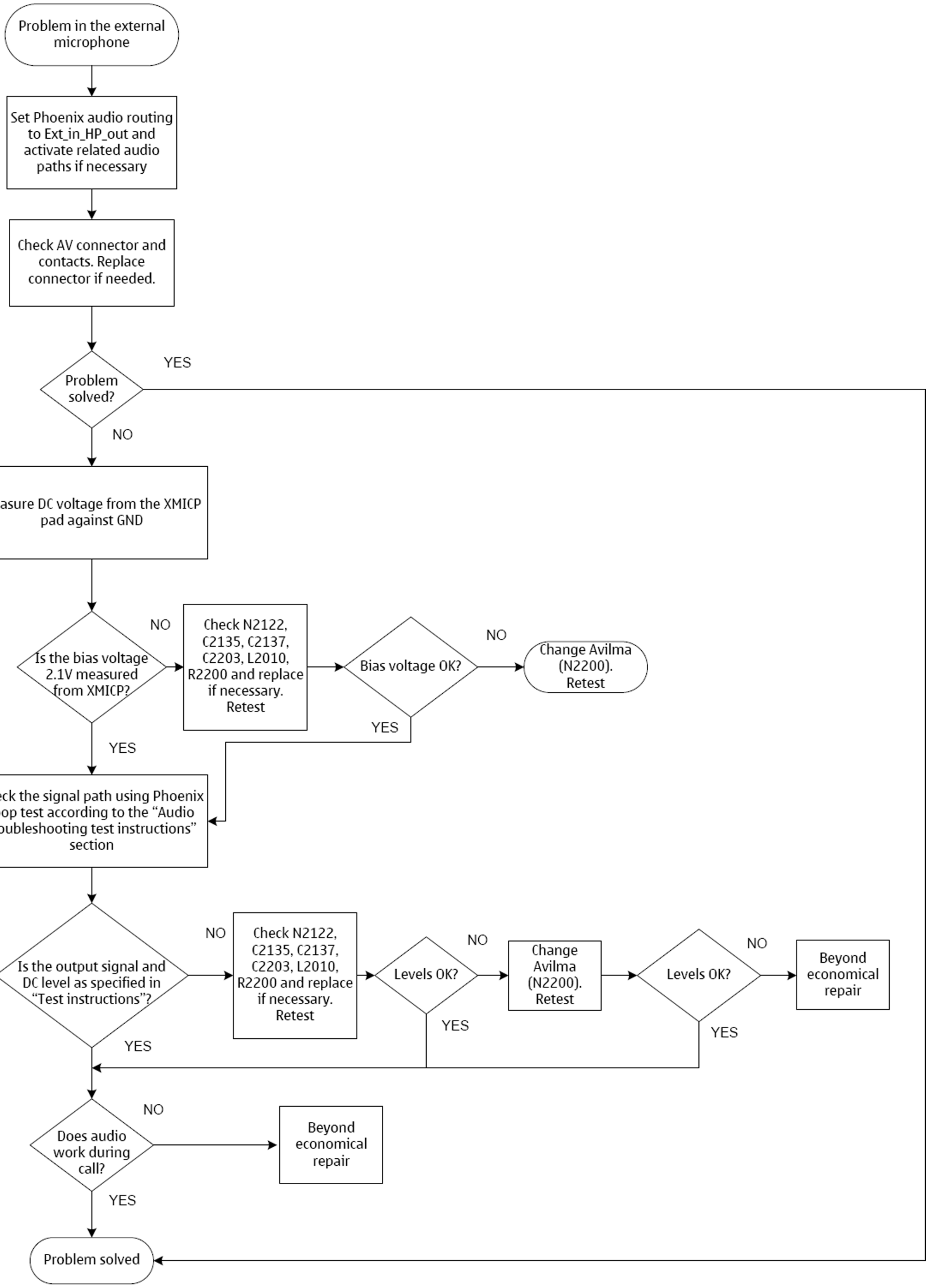
Internal handsfree speaker troubleshooting

Troubleshooting flow


Problem in the internal handsfree speakers
Set Phoenix audio routing to Ext_in IHF_out mode and activate related audio paths if necessary
Check the speaker modules and PWB connections. Replace damaged component.
Problem solved
YES
NO
Check the signal path using Phoenix test loop testing according to the "Audio troubleshooting test instructions" section
Is the output signal level as specified in "Test instructions"
NO
YES
Check C2156, C2157, L2150, L2151, L2152, L2153, R2150, R2151 and replace if necessary. Retest.
Levels OK?
NO
YES
Change Avilma (N2200). Retest.
Levels OK?
YES
NO
Does audio work during a call
NO
YES
Beyond economical repair
Problem solved

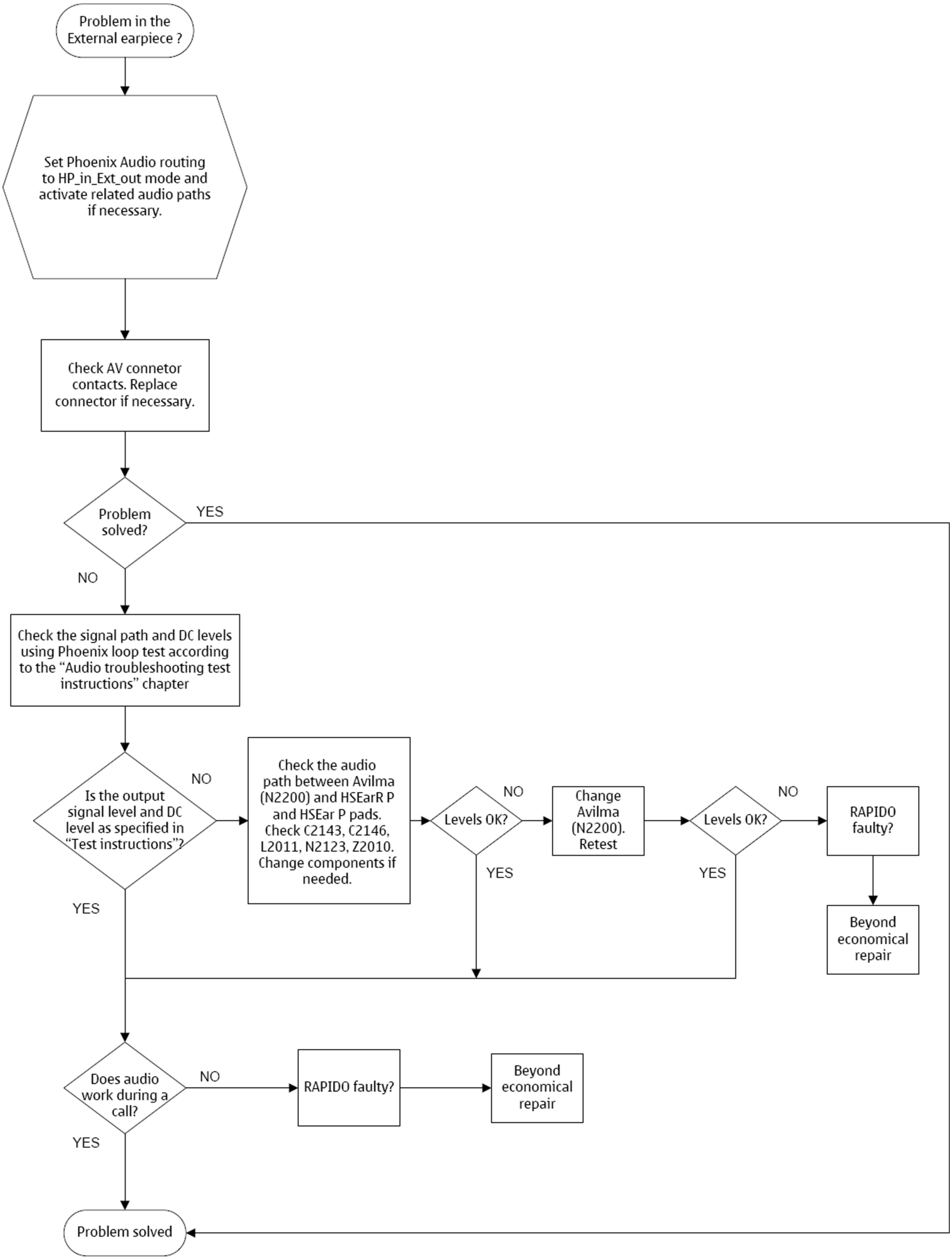
External microphone troubleshooting

Troubleshooting flow


Problem in the external microphone
Set Phoenix audio routing to Ext_in_HP_out and activate related audio paths if necessary
Check AV connector and contacts. Replace connector if needed.
Problem solved?
YES
NO
Measure DC voltage from the XMICP pad against GND
Is the bias voltage 2.1V measured from XMICP?
NO
Check N2122, C2135, C2137, C2203, L2010, R2200 and replace if necessary. Retest
Bias voltage OK?
NO
Change Avilma (N2200). Retest
YES
YES
Check the signal path using Phoenix loop test according to the “Audio troubleshooting test instructions” section
Is the output signal and DC level as specified in “Test instructions”?
NO
Check N2122, C2135, C2137, C2203, L2010, R2200 and replace if necessary. Retest
Levels OK?
NO
Change Avilma (N2200). Retest
Levels OK?
NO
Beyond economical repair
YES
YES
YES
Does audio work during call?
NO
Beyond economical repair
YES
Problem solved

External headset earpiece troubleshooting

Troubleshooting flow


Problem in the External earpiece ?
Set Phoenix Audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check AV connetor contacts. Replace connector if necessary.
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Audio troubleshooting test instructions" chapter
Is the output signal level and DC level as specified in "Test instructions"?
NO
YES
Check the audio path between Avilma (N2200) and HSEarR P and HSEar P pads. Check C2143, C2146, L2011, N2123, Z2010. Change components if needed.
Levels OK?
NO
YES
Change Avilma (N2200). Retest
Levels OK?
NO
YES
RAPIDO faulty?
Beyond economical repair
Does audio work during a call?
NO
YES
RAPIDO faulty?
Beyond economical repair
Problem solved

Acoustics troubleshooting

Introduction to acoustics troubleshooting

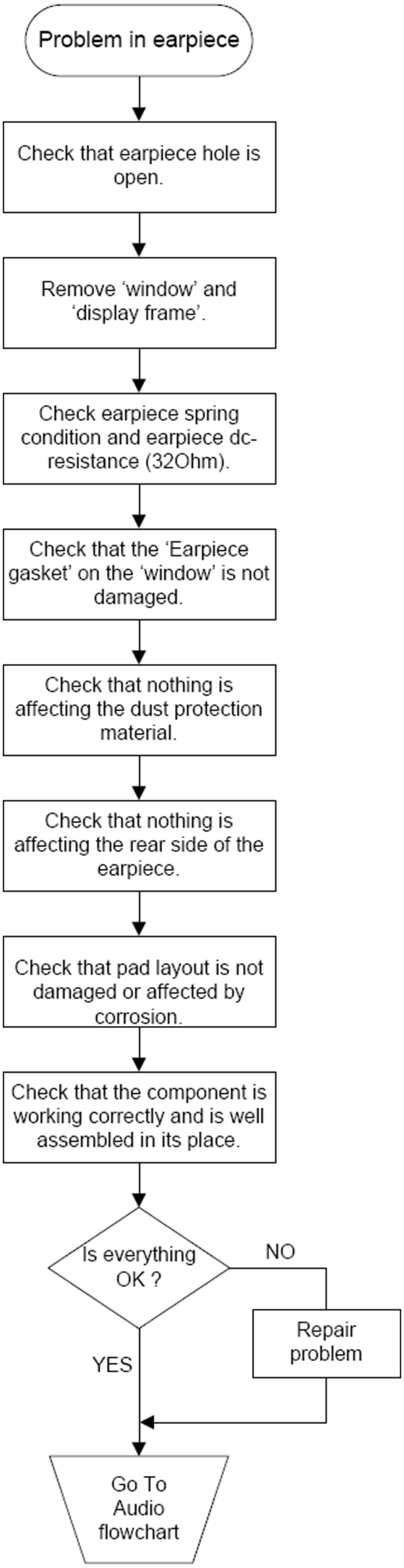
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates through a single sound hole located at the top of the phone. The microphone is located on the left corner of the USB connector at the bottom of the phone.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

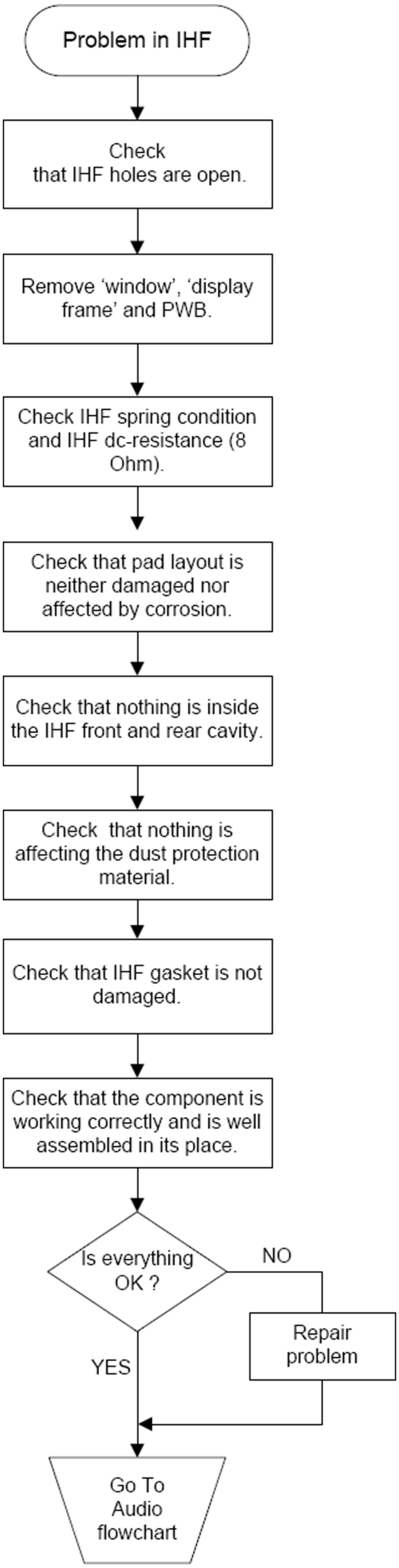
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open.
Remove 'window' and 'display frame'.
Check earpiece spring condition and earpiece dc-resistance (32Ohm).
Check that the 'Earpiece gasket' on the 'window' is not damaged.
Check that nothing is affecting the dust protection material.
Check that nothing is affecting the rear side of the earpiece.
Check that pad layout is not damaged or affected by corrosion.
Check that the component is working correctly and is well assembled in its place.
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

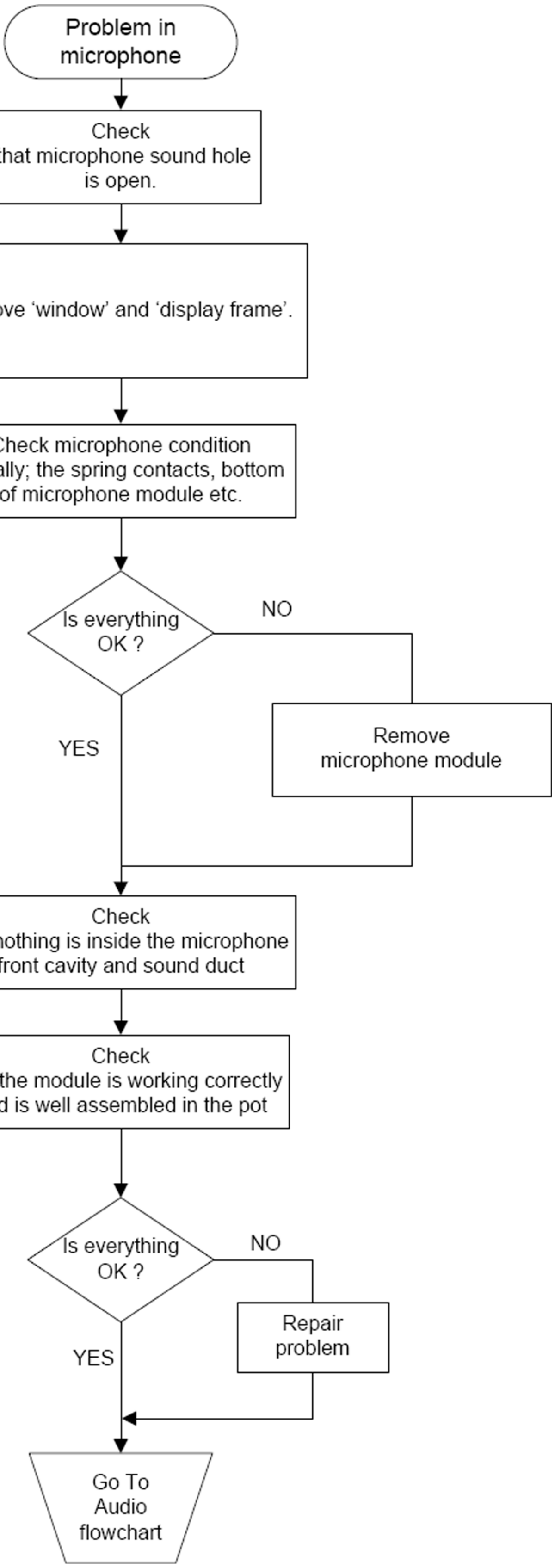
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check that IHF holes are open.
Remove 'window', 'display frame' and PWB.
Check IHF spring condition and IHF dc-resistance (8 Ohm).
Check that pad layout is neither damaged nor affected by corrosion.
Check that nothing is inside the IHF front and rear cavity.
Check that nothing is affecting the dust protection material.
Check that IHF gasket is not damaged.
Check that the component is working correctly and is well assembled in its place.
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone sound hole is open.
Remove 'window' and 'display frame'.
Check microphone condition visually; the spring contacts, bottom of microphone module etc.
Is everything OK ?
NO
Remove microphone module
YES
Check that nothing is inside the microphone front cavity and sound duct
Check that the module is working correctly and is well assembled in the pot
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Baseband manual tuning guide

Certificate restoring

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-10 or FPS-21.

  Note: If the COMBO memory of a phone is replaced, the ENO SW must be flashed first before performing the "normal" firmware flashing.
- Execute the certificate restore process in Phoenix.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2008.34.6 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables testing and tuning features)
- External smart card reader
- Activated FPS-10 **OR** FPS-21 flash prommer
- Latest flash update package for FPS-10 or FPS-21 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.

   Note: If the COMBO memory of a phone is replaced, the ENO SW must be flashed first before performing the "normal" firmware flashing.
2. Execute the certificate restore process in Phoenix.

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 11 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

4 — RF troubleshooting

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General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520
- WCDMA PA N7540

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

Note: A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible without replacing the whole shield frame (i.e. not replaceable). Please refer to the list of Non-replaceable RF components (page 4–8).

RF key components

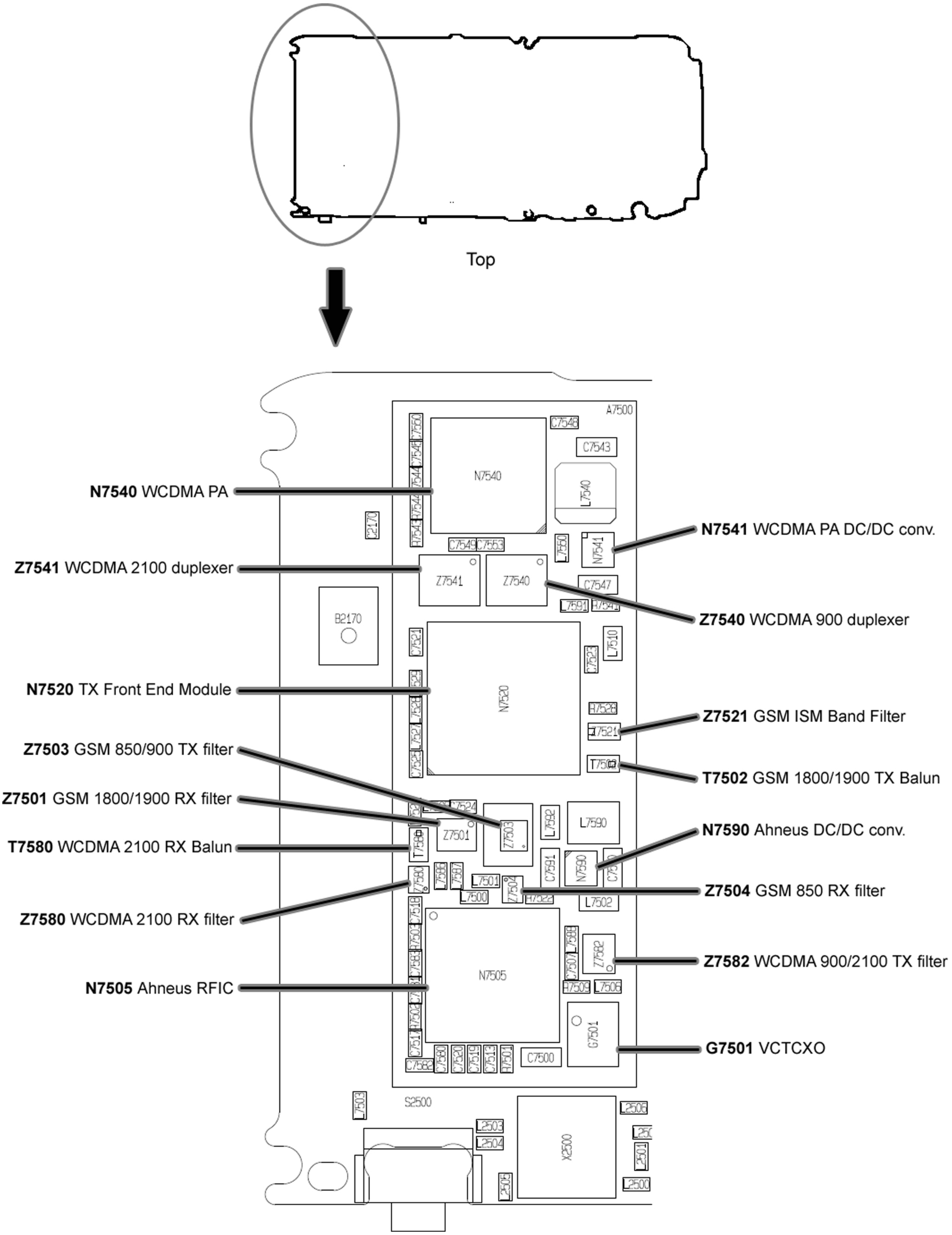
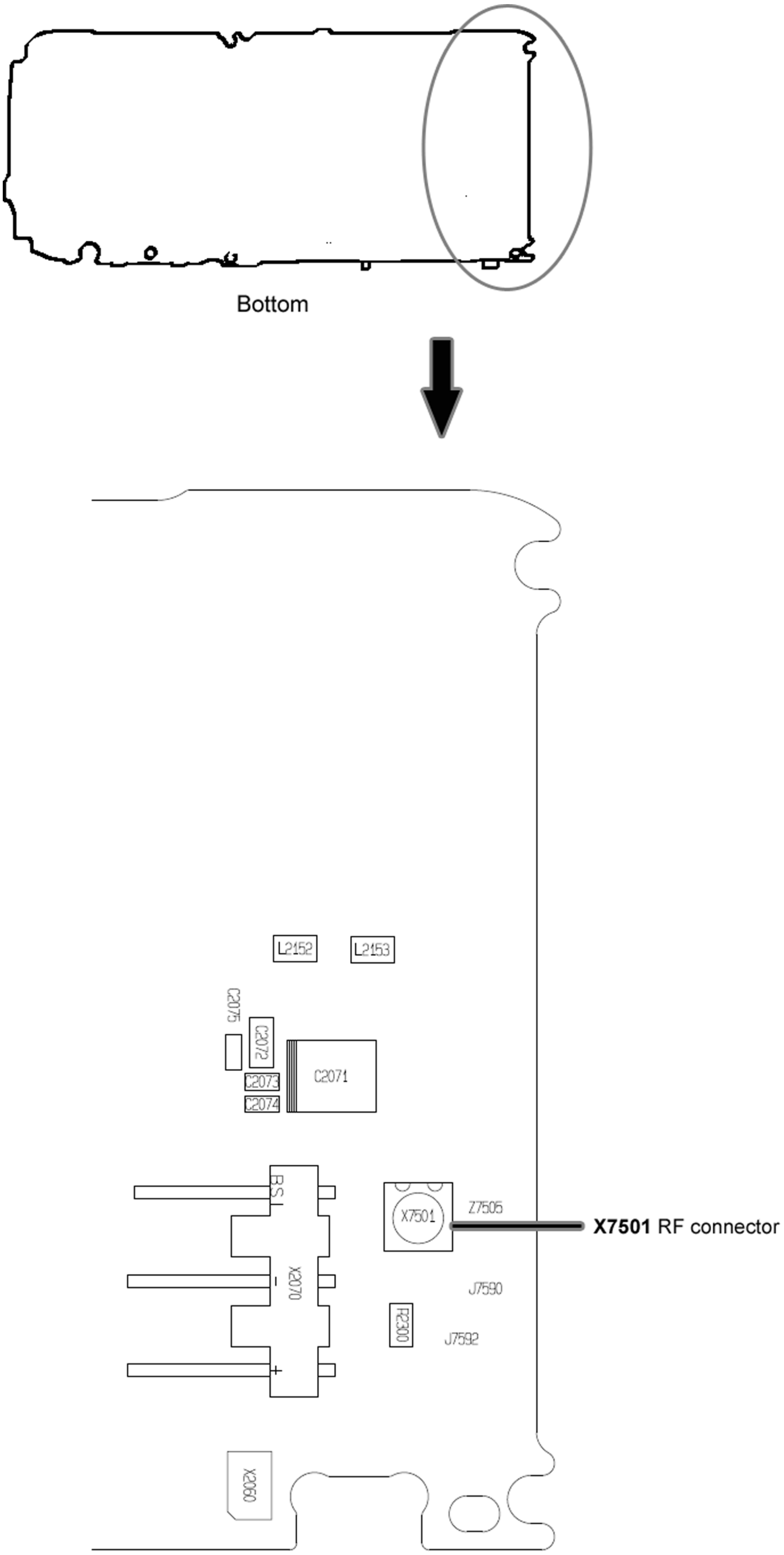

Top
N7540 WCDMA PA
Z7541 WCDMA 2100 duplexer
N7520 TX Front End Module
Z7503 GSM 850/900 TX filter
Z7501 GSM 1800/1900 RX filter
T7580 WCDMA 2100 RX Balun
Z7580 WCDMA 2100 RX filter
N7505 Ahneus RFIC
N7541 WCDMA PA DC/DC conv.
Z7540 WCDMA 900 duplexer
Z7521 GSM ISM Band Filter
T7502 GSM 1800/1900 TX Balun
N7590 Ahneus DC/DC conv.
Z7504 GSM 850 RX filter
Z7582 WCDMA 900/2100 TX filter
G7501 VCTCXO
A7500
C7548
C7543
N7540
L7540
C7549
C7553
Z7541
Z7540
C7547
L7591
B2170
N7520
L7510
Z7501
Z7503
L7590
N7590
L7501
L7500
L7502
N7505
Z7582
L7506
G7501
C7500
S2500
X2500
L2503
L2504
L2506
L2500

Figure 35 RF key components - top

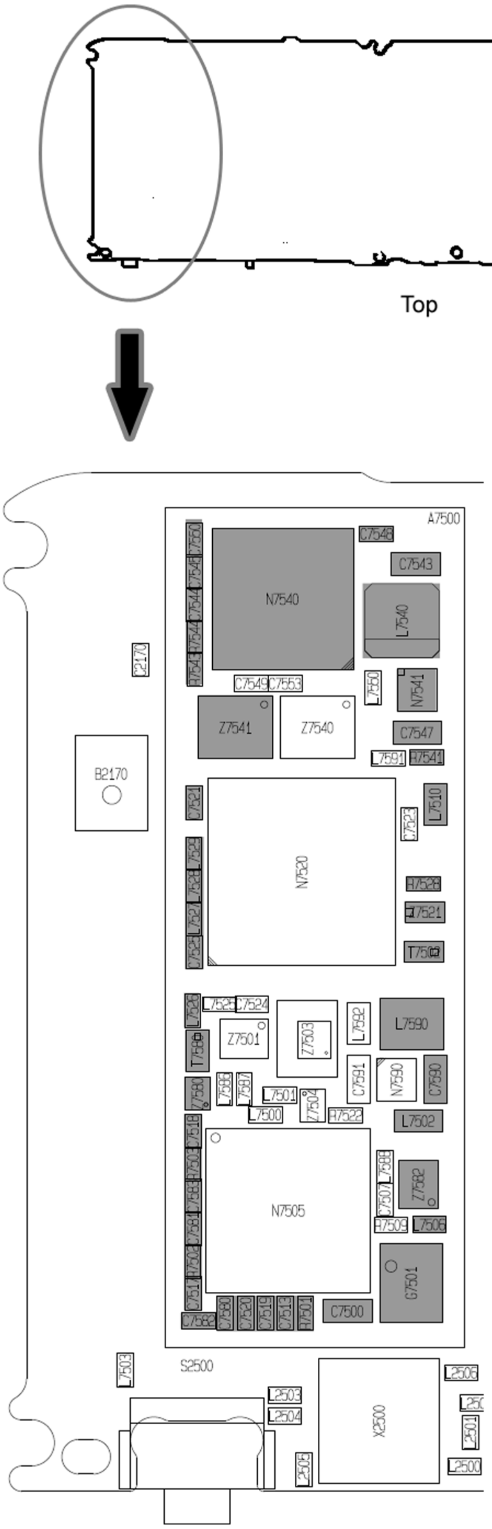

Bottom
L2152
L2153
C2075
C2072
C2073
C2074
C2071
BSI
X2070
X7501
Z7505
J7590
R2300
J7592
X2060

X7501 RF connector

Figure 36 RF key components - bottom

Non-replaceable RF components

Because of their location on the PWB, the following RF components cannot be replaced without replacing the whole shield frame:


Top
A7500
N7540
C7548
C7543
L7540
N7541
C7547
Z7541
Z7540
R2170
B2170
N7520
L7510
Z7501
Z7503
L7590
N7590
C7590
L7502
N7505
Z7582
G7501
C7500
S2500
X2500

Non-replaceable RF components

C7500
C7513
C7517
C7518
C7519
C7520
C7521
C7543
C7544
C7545
C7547
C7548
C7550
C7580
C7581
C7582
C7583
C7590
G7501
L7502
L7506
L7510
L7527
L7528
L7529
L7540
L7590
N7540
N7541
R7501
R7502
R7503
R7525
R7526
R7528
R7541
R7543
R7544
T7502
T7580
Z7521
Z7541
Z7580
Z7582

Note! The RF components listed above can be replaced only by replacing the whole shield frame.

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.2 V
3	FEM supply	L7510	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V when transmitting)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7592	3.9 V

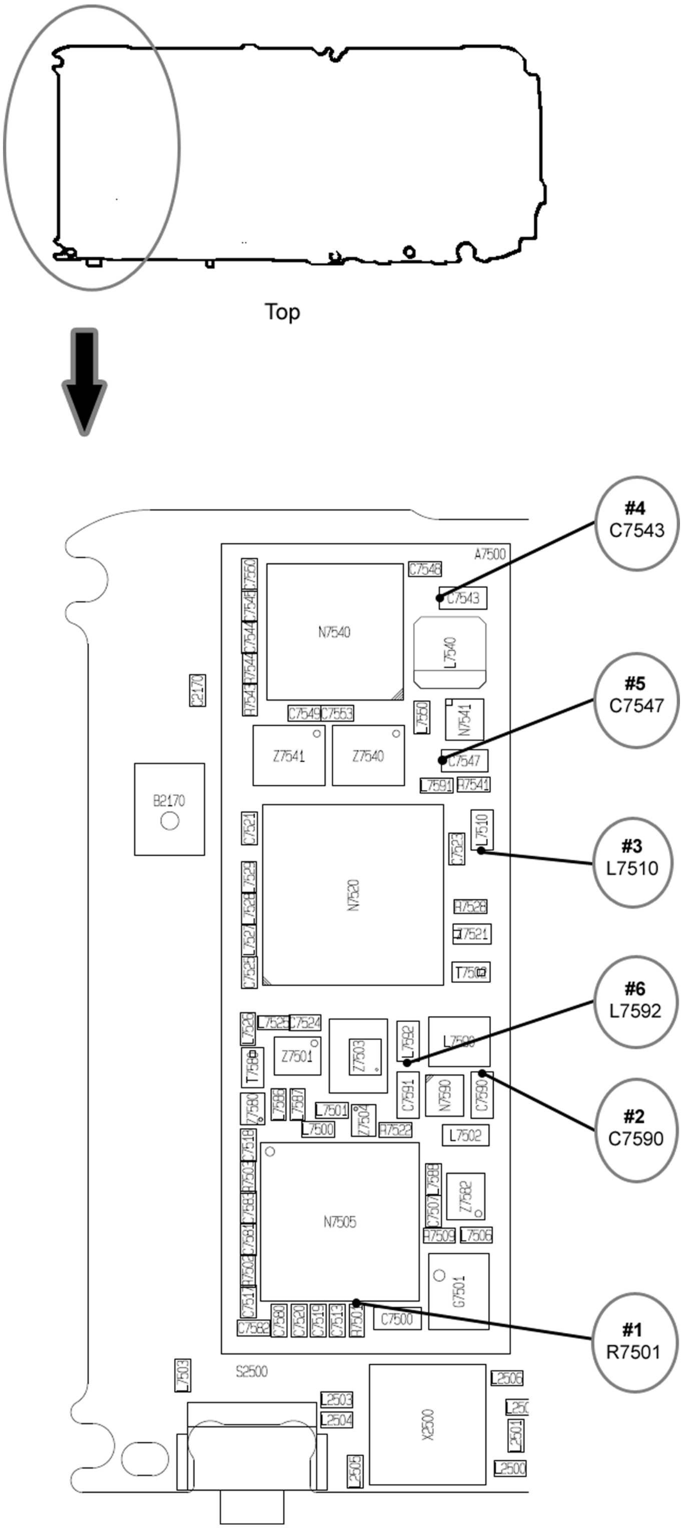

Top
#4 C7543
#5 C7547
#3 L7510
#6 L7592
#2 C7590
#1 R7501
A7500
N7540
L7540
Z7541
Z7540
N7541
B2170
N7520
Z7501
N7505
G7501
C7500
S2500
X2500

Figure 37 General voltage checking test points

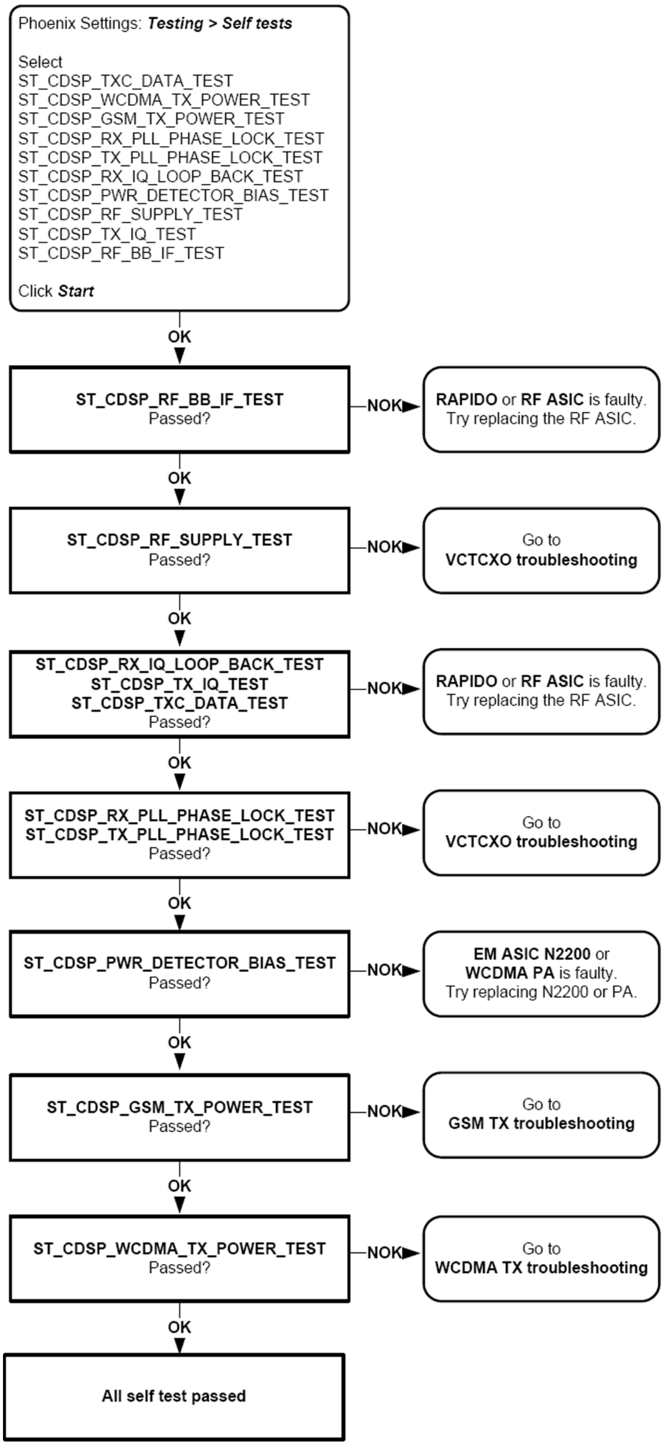
Phoenix self tests

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

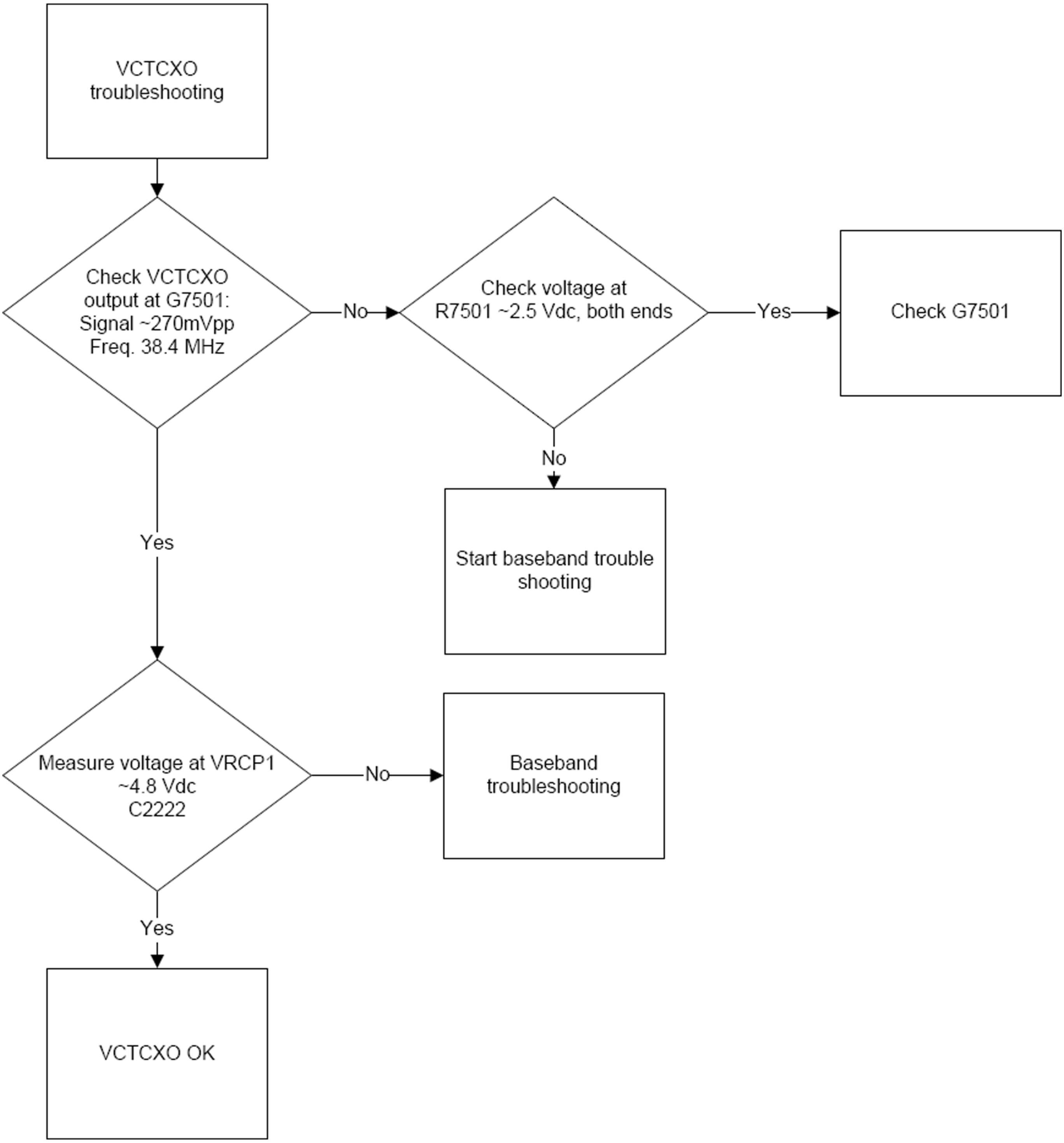
If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.* in the baseband troubleshooting section.

Troubleshooting flow


Phoenix Settings: ***Testing > Self tests***
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click ***Start***
OK
ST_CDSP_RF_BB_IF_TEST Passed?
NOK
RAPIDO or **RF ASIC** is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RF_SUPPLY_TEST Passed?
NOK
Go to **VCTCXO troubleshooting**
OK
ST_CDSP_RX_IQ_LOOP_BACK_TEST ST_CDSP_TX_IQ_TEST ST_CDSP_TXC_DATA_TEST Passed?
NOK
RAPIDO or **RF ASIC** is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RX_PLL_PHASE_LOCK_TEST ST_CDSP_TX_PLL_PHASE_LOCK_TEST Passed?
NOK
Go to **VCTCXO troubleshooting**
OK
ST_CDSP_PWR_DETECTOR_BIAS_TEST Passed?
NOK
EM ASIC N2200 or **WCDMA PA** is faulty. Try replacing N2200 or PA.
OK
ST_CDSP_GSM_TX_POWER_TEST Passed?
NOK
Go to **GSM TX troubleshooting**
OK
ST_CDSP_WCDMA_TX_POWER_TEST Passed?
NOK
Go to **WCDMA TX troubleshooting**
OK
All self test passed

VCTCXO troubleshooting

Troubleshooting flow


VCTCXO troubleshooting
Check VCTCXO output at G7501: Signal ~270mVpp Freq. 38.4 MHz
No
Check voltage at R7501 ~2.5 Vdc, both ends
Yes
Check G7501
No
Start baseband trouble shooting
Yes
Measure voltage at VRCP1 ~4.8 Vdc C2222
No
Baseband troubleshooting
Yes
VCTCXO OK

Receiver troubleshooting

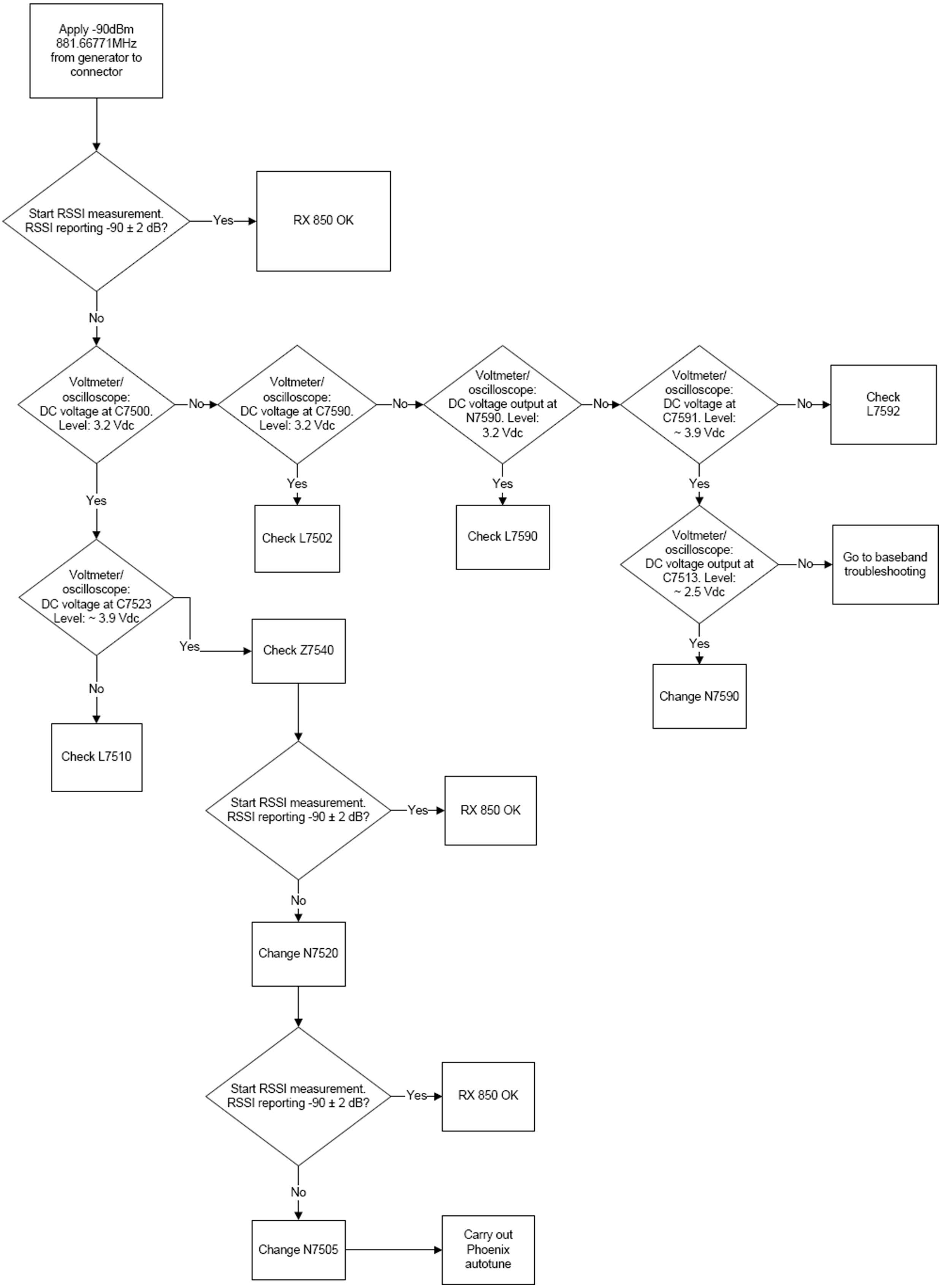
Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 4–18). For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 4–21).

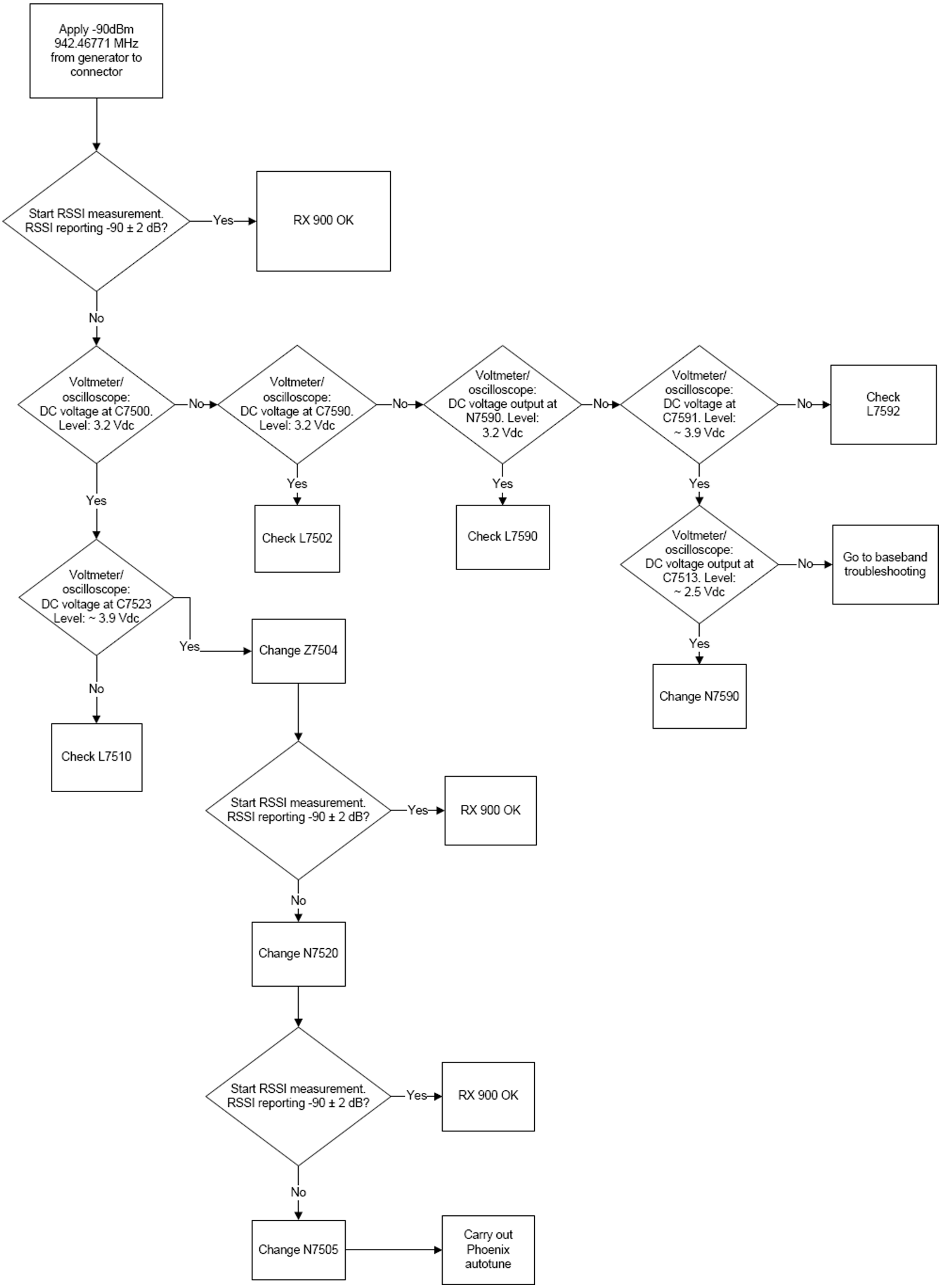
RX GSM850 troubleshooting

Troubleshooting flow


Apply -90dBm 881.66771MHz from generator to connector
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 850 OK
No
Voltmeter/ oscilloscope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ oscilloscope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Voltmeter/ oscilloscope: DC voltage at C7523 Level: ~ 3.9 Vdc
Yes
Check Z7540
No
Check L7510
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 850 OK
No
Change N7520
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 850 OK
No
Change N7505
Carry out Phoenix autotune

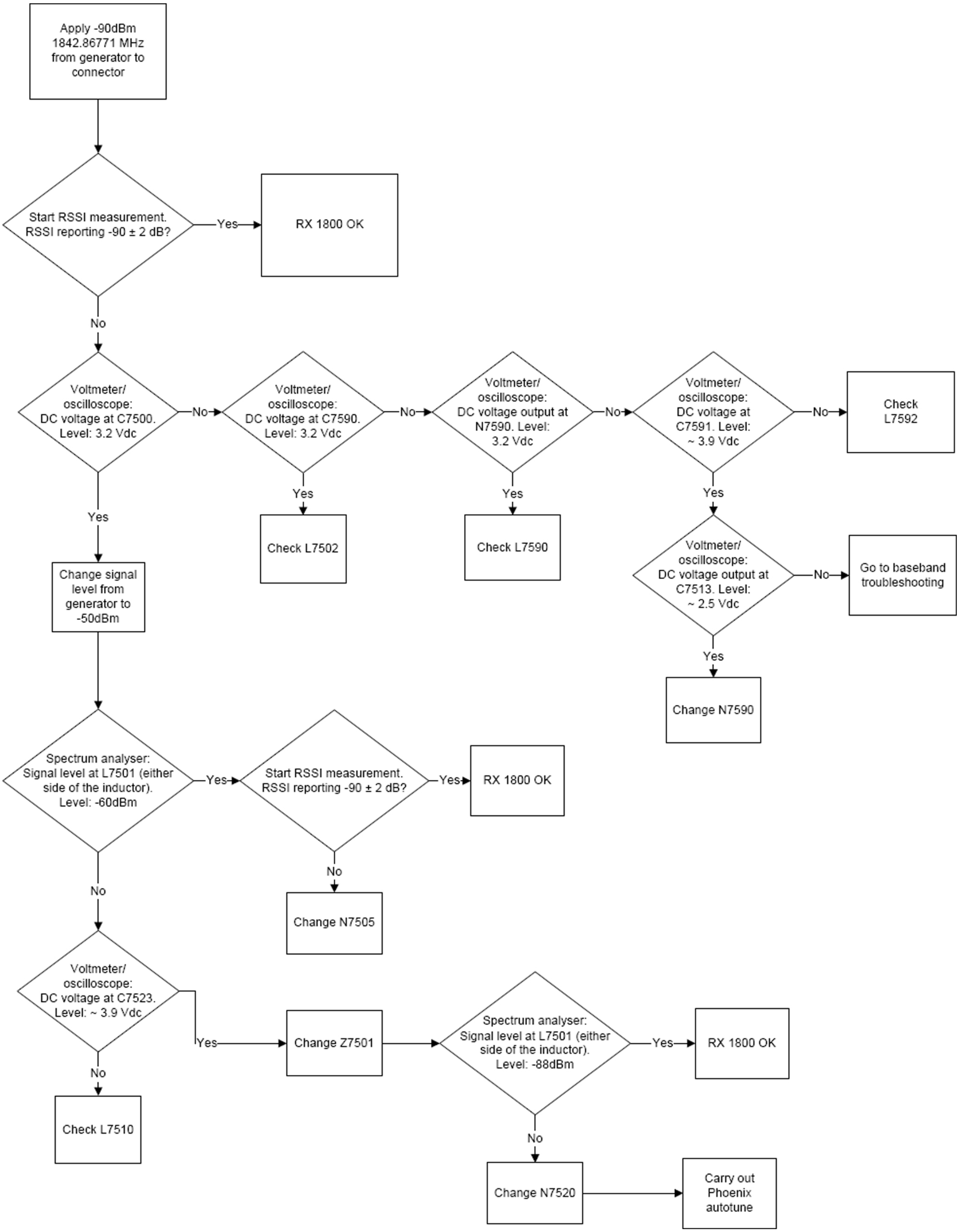
RX GSM900 troubleshooting

Troubleshooting flow


Apply -90dBm 942.46771 MHz from generator to connector
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 900 OK
No
Voltmeter/ oscilloscope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ oscilloscope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Voltmeter/ oscilloscope: DC voltage at C7523 Level: ~ 3.9 Vdc
Yes
Change Z7504
No
Check L7510
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 900 OK
No
Change N7520
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 900 OK
No
Change N7505
Carry out Phoenix autotune

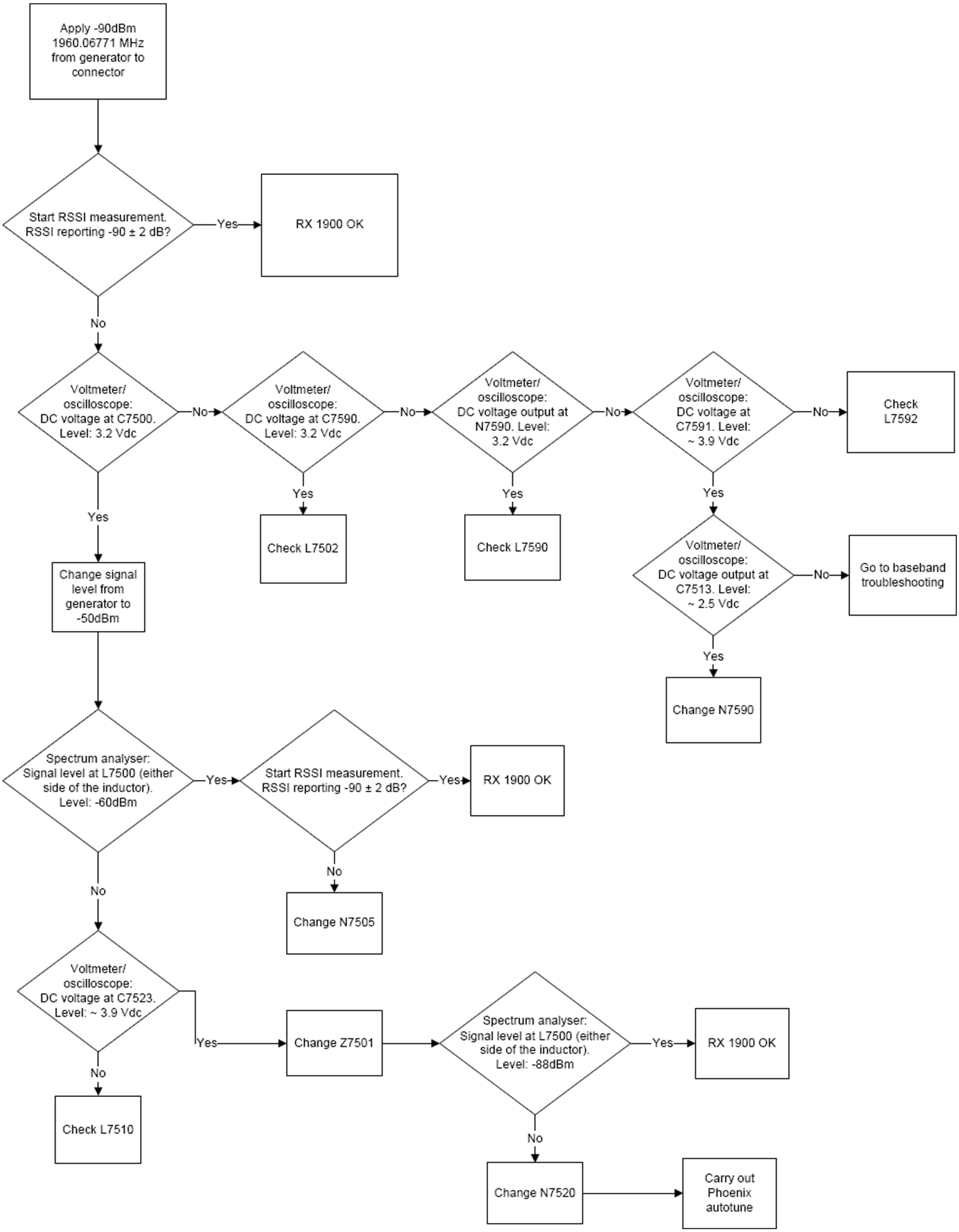
RX GSM1800 troubleshooting

Troubleshooting flow


Apply -90dBm 1842.86771 MHz from generator to connector
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 1800 OK
No
Voltmeter/ oscilloscope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ oscilloscope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Change signal level from generator to -50dBm
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level: -60dBm
Yes
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 1800 OK
No
Change N7505
No
Voltmeter/ oscilloscope: DC voltage at C7523. Level: ~ 3.9 Vdc
Yes
Change Z7501
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level: -88dBm
Yes
RX 1800 OK
No
Change N7520
Carry out Phoenix autotune
No
Check L7510

RX GSM1900 troubleshooting

Troubleshooting flow


Apply -90dBm 1960.06771 MHz from generator to connector
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 1900 OK
No
Voltmeter/ oscilloscope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ oscilloscope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Change signal level from generator to -50dBm
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level: -60dBm
Yes
Start RSSI measurement. RSSI reporting -90 ± 2 dB?
Yes
RX 1900 OK
No
Change N7505
No
Voltmeter/ oscilloscope: DC voltage at C7523. Level: ~ 3.9 Vdc
Yes
Change Z7501
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level: -88dBm
Yes
RX 1900 OK
No
Change N7520
Carry out Phoenix autotune
No
Check L7510

GSM RX chain activation for manual measurements/GSM RSSI measurement

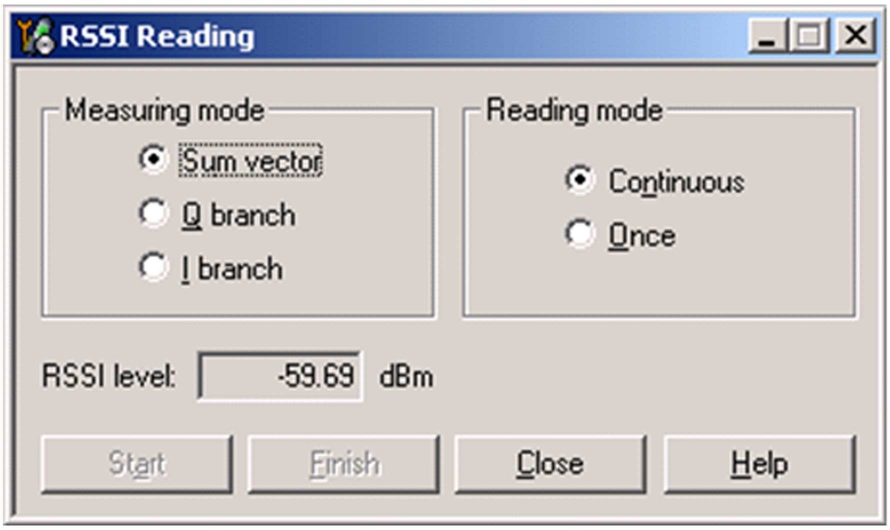
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71kHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -59.69 dBm

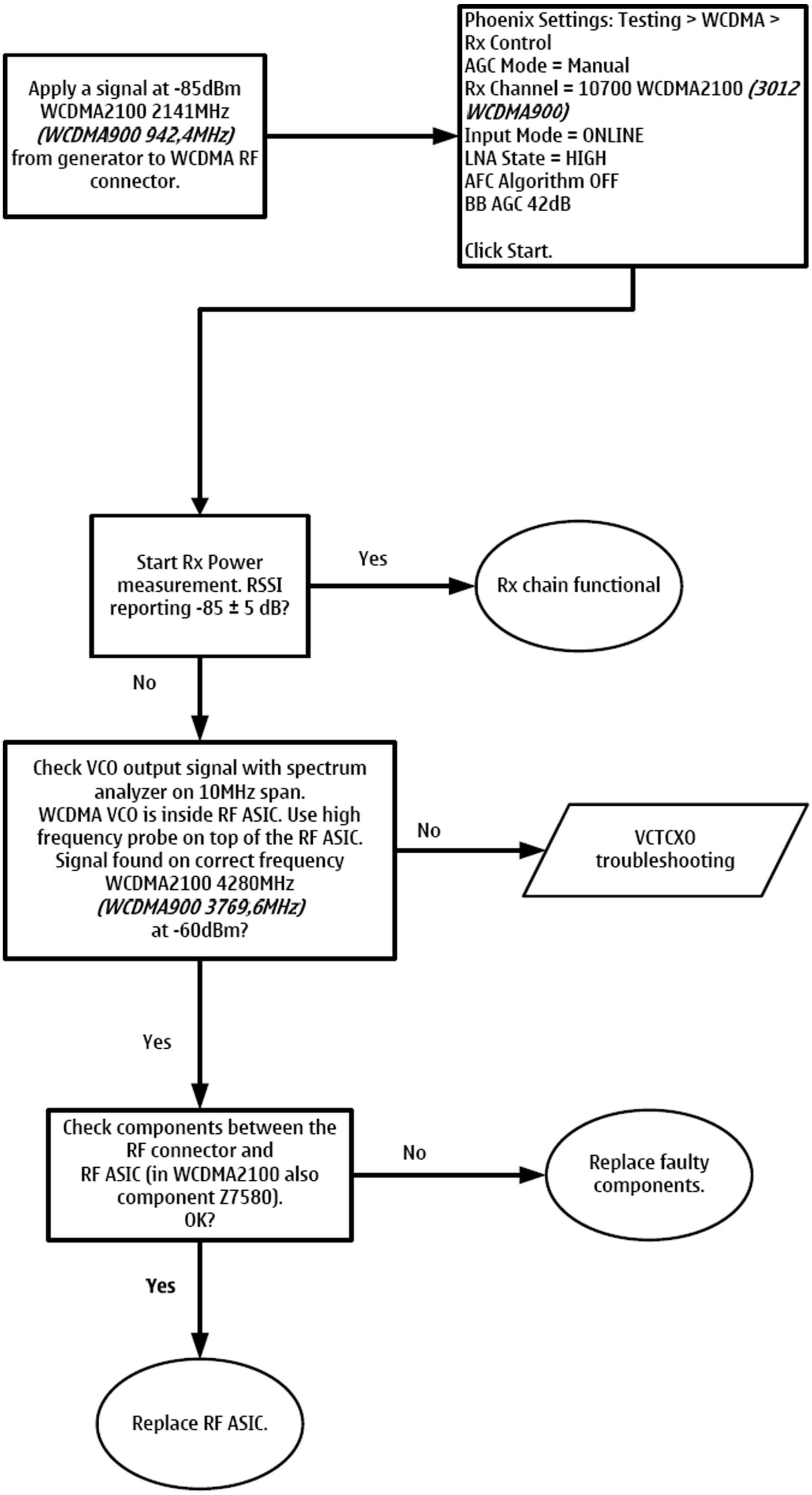
Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

WCDMA receiver troubleshooting

Troubleshooting flow


Apply a signal at -85dBm WCDMA2100 2141MHz *(WCDMA900 942,4MHz)* from generator to WCDMA RF connector.
Phoenix Settings: Testing > WCDMA > Rx Control
AGC Mode = Manual
Rx Channel = 10700 WCDMA2100 *(3012 WCDMA900)*
Input Mode = ONLINE
LNA State = HIGH
AFC Algorithm OFF
BB AGC 42dB
Click Start.
Start Rx Power measurement. RSSI reporting -85 ± 5 dB?
Yes
Rx chain functional
No
Check VCO output signal with spectrum analyzer on 10MHz span. WCDMA VCO is inside RF ASIC. Use high frequency probe on top of the RF ASIC. Signal found on correct frequency WCDMA2100 4280MHz *(WCDMA900 3769,6MHz)* at -60dBm?
No
VCTCXO troubleshooting
Yes
Check components between the RF connector and RF ASIC (in WCDMA2100 also component Z7580). OK?
No
Replace faulty components.
Yes
Replace RF ASIC.

WCDMA RX chain activation for manual measurement

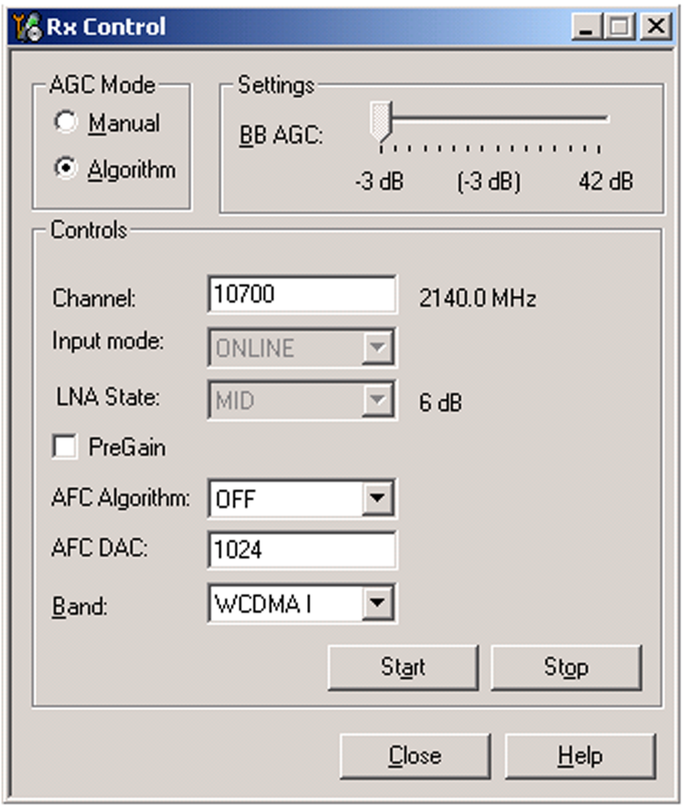
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100	WCDMA900
Phoenix Channel	10700	3012
Signal generator to antenna connector	2141.0 MHz	942,4 MHz
Band	I	VIII

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:

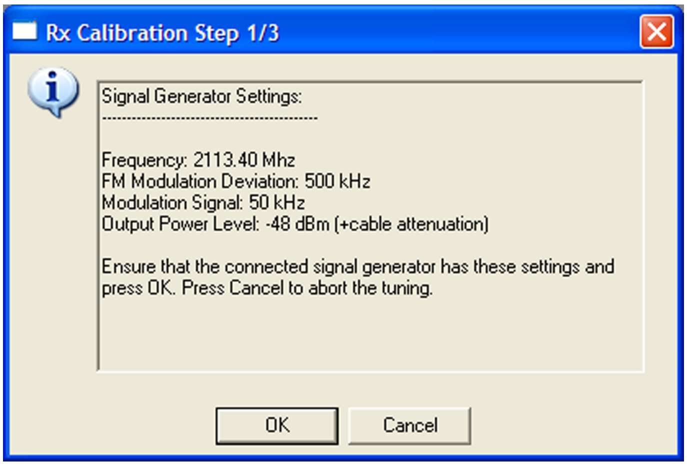

Rx Control
AGC Mode
○ Manual
● Algorithm
Settings
BB AGC:
-3 dB
(-3 dB)
42 dB
Controls
Start
Stop
Close
Help

Channel: 10700 2140.0 MHz
Input mode: ONLINE
LNA State: MID 6 dB
☐ PreGain
AFC Algorithm: OFF
AFC DAC: 1024
Band: WCDMA I

3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.
4. Set the following RF generator settings:



Signal Generator Settings:

Frequency: 2113.40 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 38 WCDMA RX generator settings

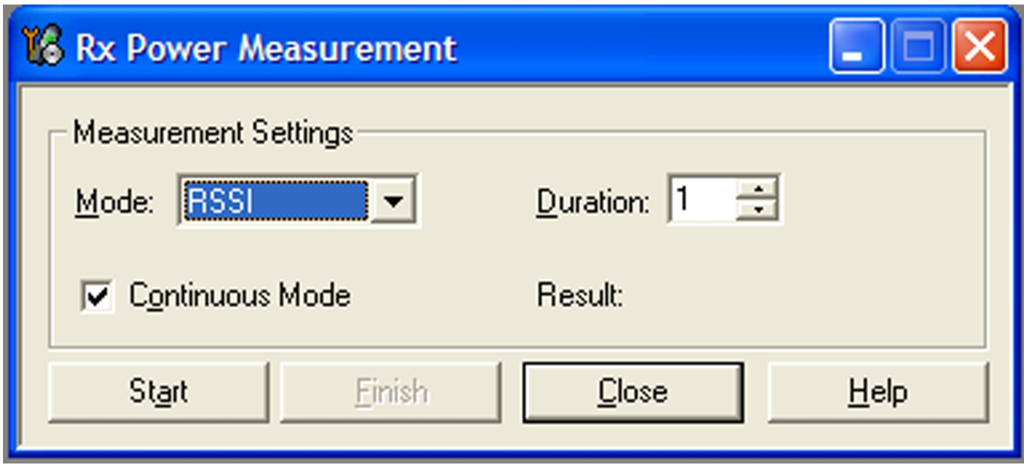
WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation (page 4–20).

Steps

1. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
2. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode



Mode: RSSI
Duration: 1
☑ Continuous Mode

3. Click **Start** to perform the measurement.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.

- The most useful Phoenix tool for GSM transmitter testing is "RF Controls"; in WCDMA transmitter testing the best tool is "TX Control".
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

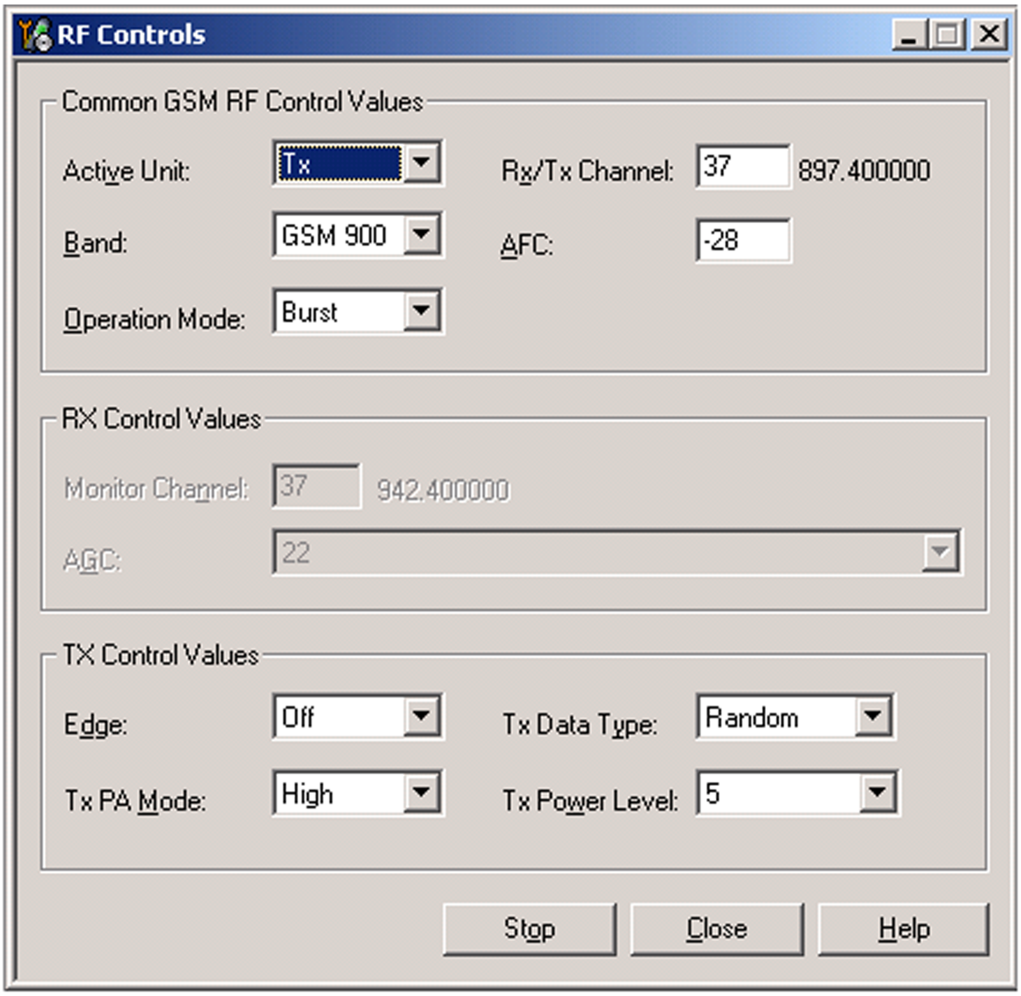
Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Use the following settings:



RF Controls

Common GSM RF Control Values

Active Unit: Tx
Rx/Tx Channel: 37 897.400000
Band: GSM 900
AFC: -28
Operation Mode: Burst

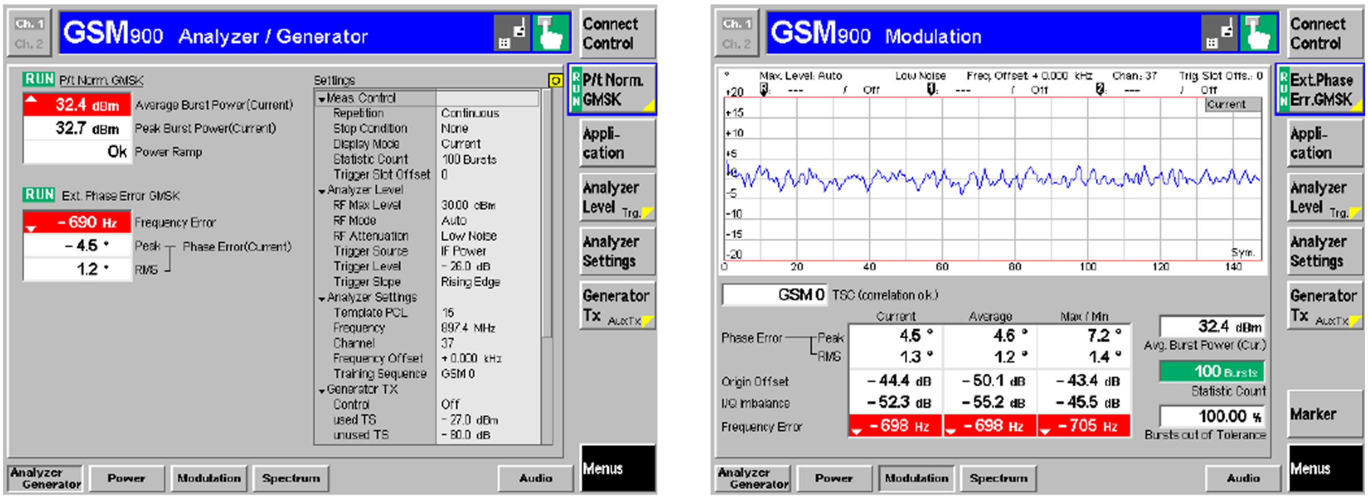
RX Control Values

Monitor Channel: 37 942.400000
AGC: 22

TX Control Values

Edge: Off
Tx Data Type: Random
Tx PA Mode: High
Tx Power Level: 5

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).



Analyser settings

GSM900 Analyzer / Generator

RUN P/t Norm. GMSK
32.4 dBm Average Burst Power(Current)
32.7 dBm Peak Burst Power(Current)
Ok Power Ramp

RUN Ext. Phase Error GMSK
-690 Hz Frequency Error
-4.5 ° Peak Phase Error(Current)
1.2 ° RMS

Settings
Meas. Control
Repetition: Continuous
Stop Condition: None
Display Mode: Current
Statistic Count: 100 Bursts
Trigger Slot Offset: 0
Analyzer Level
RF Max Level: 30.00 dBm
RF Mode: Auto
RF Attenuation: Low Noise
Trigger Source: IF Power
Trigger Level: -26.0 dB
Trigger Slope: Rising Edge
Analyzer Settings
Template PCL: 15
Frequency: 897.4 MHz
Channel: 37
Frequency Offset: +0.000 kHz
Training Sequence: GSM 0
Generator TX
Control: Off
used TS: -27.0 dBm
unused TS: -80.0 dB

Phase error

GSM900 Modulation

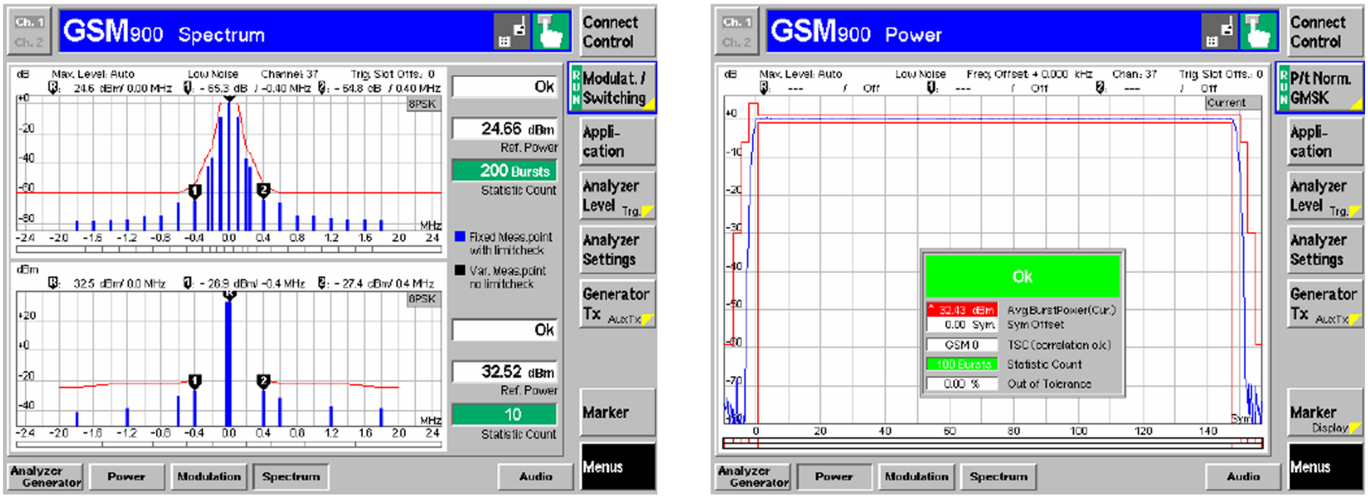
Max. Level: Auto; Low Noise; Freq. Offset: +0.000 kHz; Chan.: 37; Trig. Slot Offs.: 0

GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	4.5 °	4.6 °	7.2 °
	RMS	1.3 °	1.2 °	1.4 °
Origin Offset		-44.4 dB	-50.1 dB	-43.4 dB
I/Q Imbalance		-52.3 dB	-55.2 dB	-45.5 dB
Frequency Error		-698 Hz	-698 Hz	-705 Hz

32.4 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

Ch. 1
Ch. 2
Connect Control
P/t Norm. GMSK
Ext.Phase Err.GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio
Current
Sym.
+20
+15
+10
+5
-5
-10
-15
-20
0
20
40
60
80
100
120
140



Modulation/Switching spectrum

GSM900 Spectrum

Max. Level: Auto; Low Noise; Channel: 37; Trig. Slot Offs.: 0
24.6 dBm/ 0.00 MHz; -65.3 dB / -0.40 MHz; -64.8 dB / 0.40 MHz
Ok
24.66 dBm Ref. Power
200 Bursts Statistic Count
Fixed Meas.point with limitcheck
Var. Meas.point no limitcheck
32.5 dBm/ 0.0 MHz; -26.9 dBm/ -0.4 MHz; -27.4 dBm/ 0.4 MHz
Ok
32.52 dBm Ref. Power
10 Statistic Count

Power/Burst

GSM900 Power

Max. Level: Auto; Low Noise; Freq. Offset: +0.000 kHz; Chan.: 37; Trig. Slot Offs.: 0

Ok
32.43 dBm AvgBurstPower(Cur.)
0.00 Sym. Sym Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Ch. 1
Ch. 2
Connect Control
Modulat. / Switching
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker
Marker Display
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio
8PSK
Current
dB
dBm
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
+0
-20
-40
-60
-80
+20
-10
-30
-50
-60
-70
0
20
40
60
80
100
120
140
Sym.

Figure 39 Typical readings

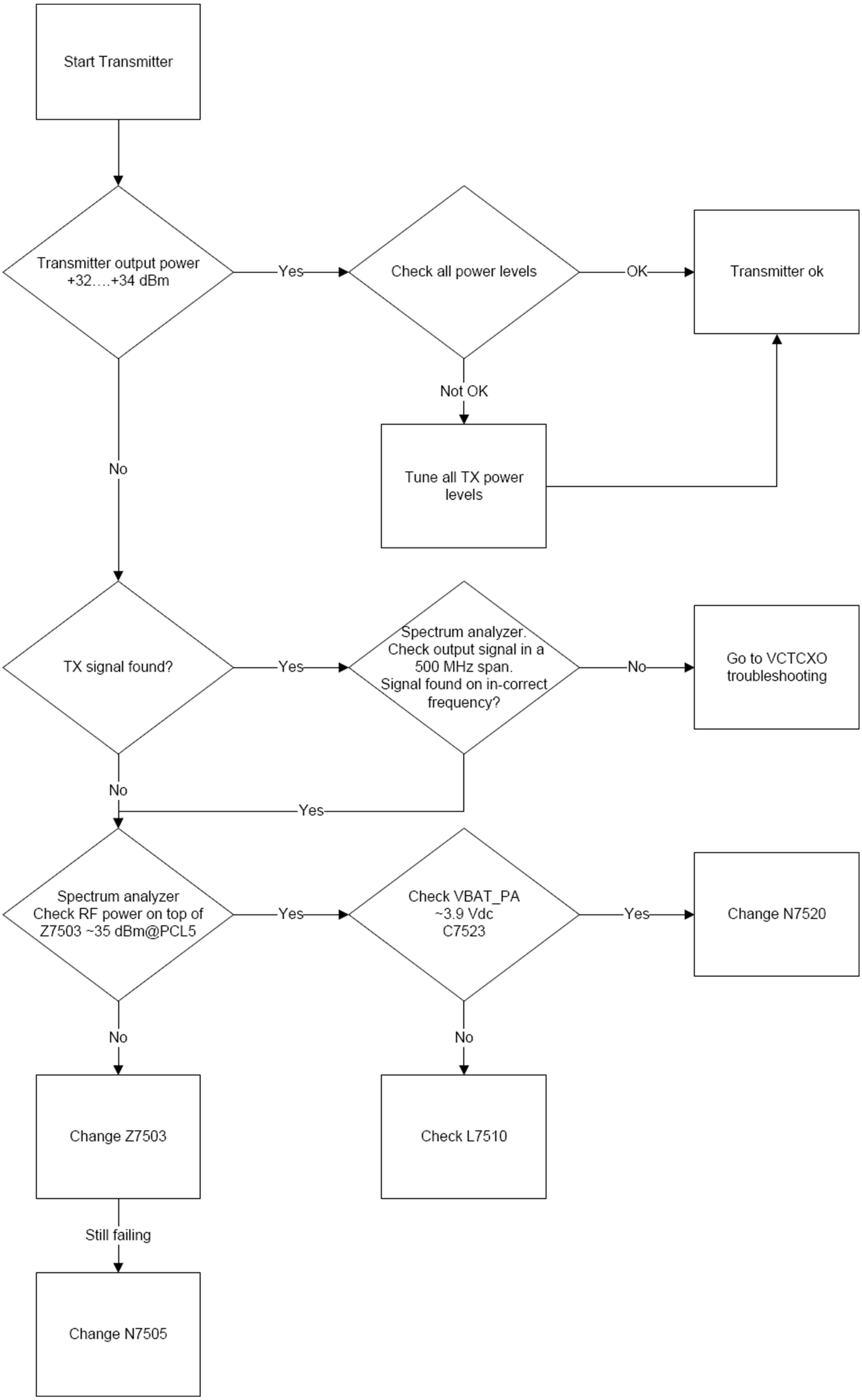
4. Change the power level (RF controls) and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

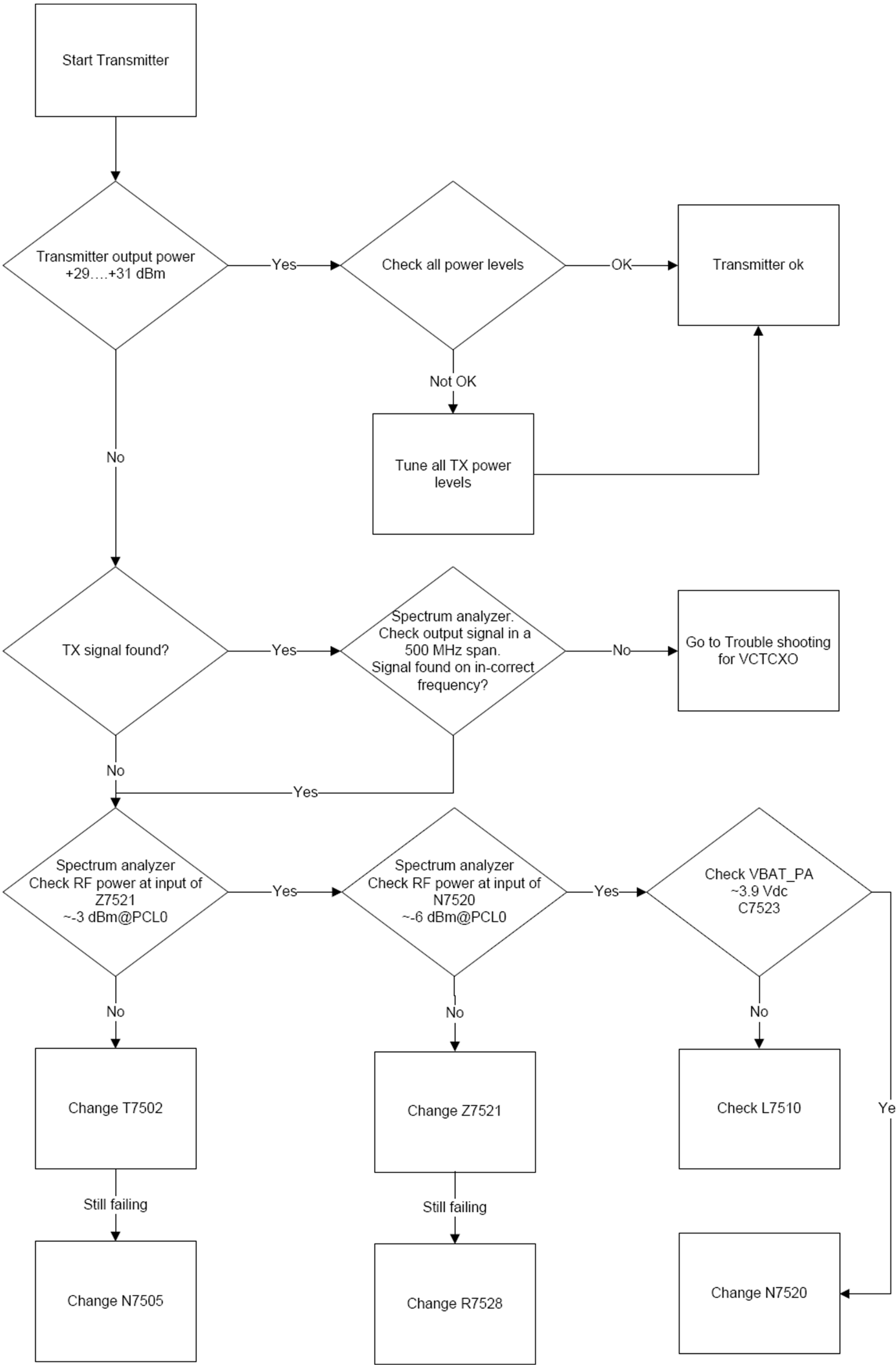
TX 850/900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +32….+34 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to VCTCXO troubleshooting
No
Yes
Spectrum analyzer Check RF power on top of Z7503 ~35 dBm@PCL5
Yes
Check VBAT_PA ~3.9 Vdc C7523
Yes
Change N7520
No
No
Change Z7503
Check L7510
Still failing
Change N7505

TX 1800/1900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +29….+31 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to Trouble shooting for VCTCXO
No
Yes
Spectrum analyzer Check RF power at input of Z7521 ~-3 dBm@PCL0
Yes
Spectrum analyzer Check RF power at input of N7520 ~-6 dBm@PCL0
Yes
Check VBAT_PA ~3.9 Vdc C7523
No
No
No
Change T7502
Change Z7521
Check L7510
Yes
Still failing
Still failing
Change N7505
Change R7528
Change N7520

Checking antenna functionality

Antenna overview

The RM-356 has a main GSM/WCDMA antenna, a BT/WLAN antenna and a GPS antenna. All the antennas are attached to the B-cover as illustrated in the figure below.

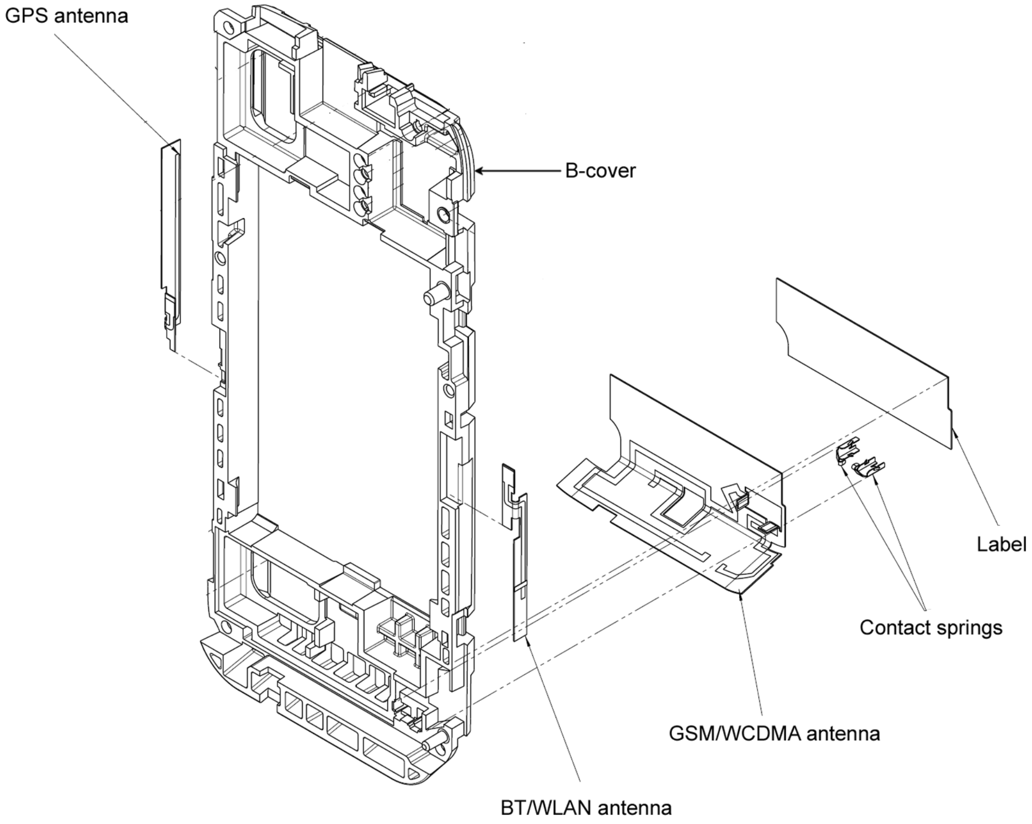


Figure 40 RM-356 antennas

GSM/WCDMA antenna functionality

The main GSM/WCDMA antenna is an IFA (Inverted F Antenna), which is divided into two branches and includes one parasitic element. The antenna is functioning normally when it is properly attached to the B-cover and the contact springs take proper contact to the PWB.

The main antenna functionality must also be checked by measuring the transmitted power with RF coupler at GSM900 channel 124.

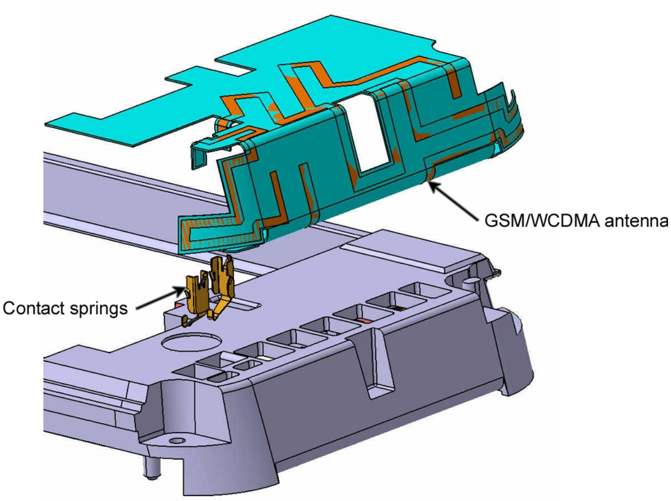


Figure 41 GSM/WCDMA antenna

BT/WLAN antenna functionality

The BT/WLAN antenna is an IFA on flex. The antenna is functioning normally when it is properly attached to the B-cover and it takes proper contact to the C-clip on the PWB.

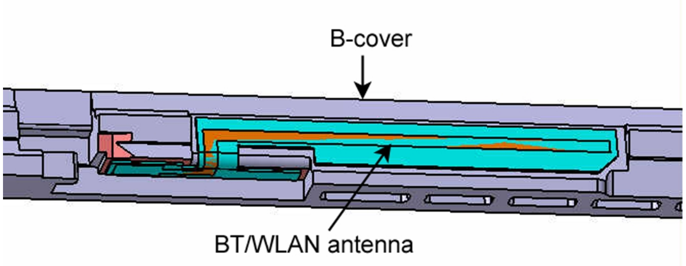


Figure 42 BT/WLAN antenna

GPS antenna functionality

The GPS antenna is a bended IFA on flex. The antenna is functioning normally when it is properly attached to the B-cover and it takes proper contact to the C-clip on the PWB.

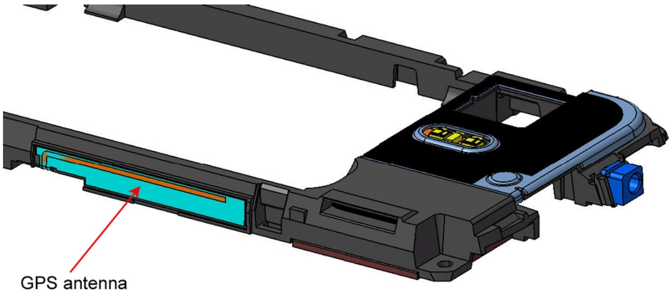


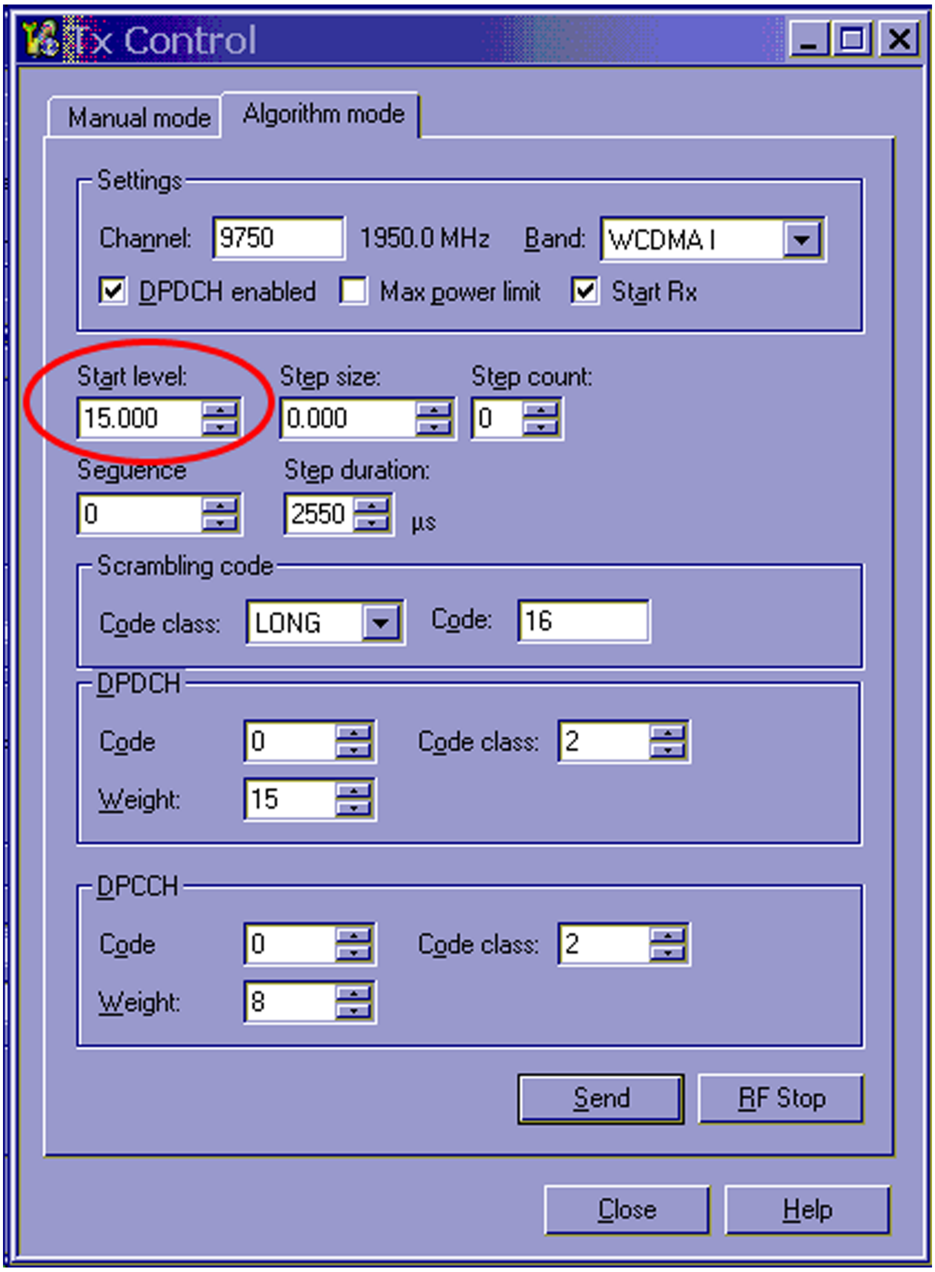
Figure 43 GPS antenna

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .

3. Use the following settings in the TX control window:



Settings

Channel: 9750 1950.0 MHz Band: WCDMA I

☑ DPDCH enabled ☐ Max power limit ☑ Start Rx

Start level: 15.000

Step size: 0.000

Step count: 0

Sequence: 0

Step duration: 2550 µs

Scrambling code

Code class: LONG

Code: 16

DPDCH

Code: 0

Code class: 2

Weight: 15

DPCCH

Code: 0

Code class: 2

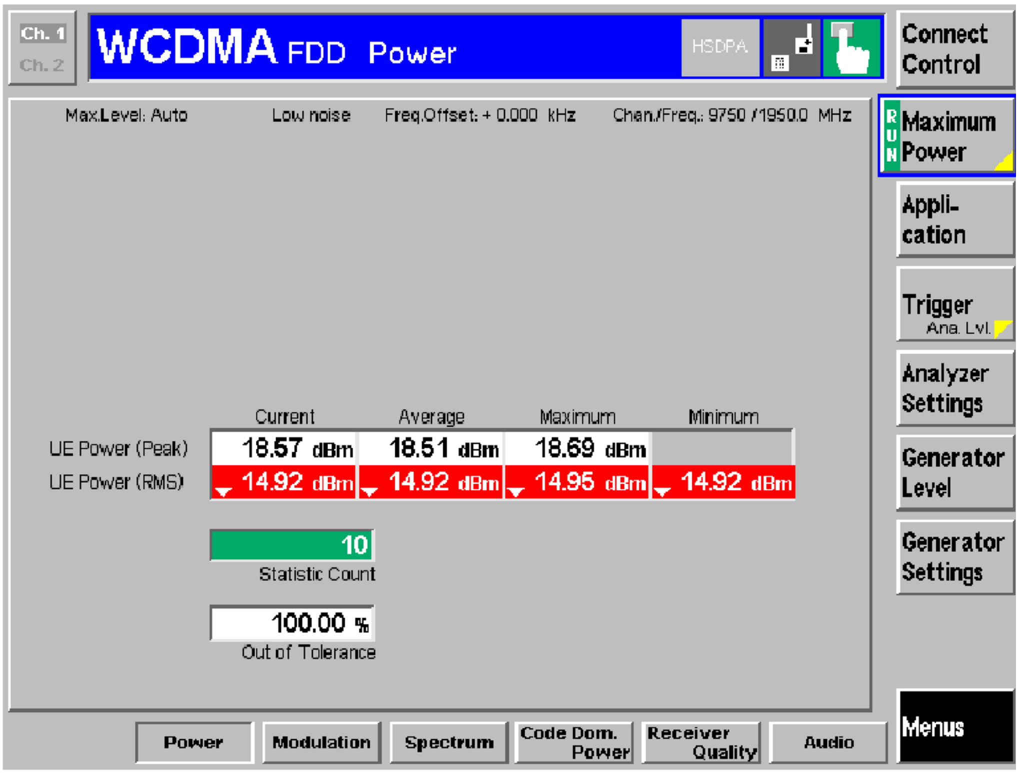
Weight: 8

Figure 44 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.
5. Use the CMU200 to check the WCDMA power.



Ch. 1
Ch. 2
WCDMA FDD Power
HSDPA
Connect Control
RUN
Maximum Power
Appli-cation
Trigger
Ana. Lvl.
Analyzer Settings
Generator Level
Generator Settings
Menus
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality
Audio

Max.Level: Auto   Low noise   Freq.Offset: + 0.000 kHz   Chan./Freq.: 9750 / 1950.0 MHz

	Current	Average	Maximum	Minimum
UE Power (Peak)	18.57 dBm	18.51 dBm	18.69 dBm	
UE Power (RMS)	14.92 dBm	14.92 dBm	14.95 dBm	14.92 dBm

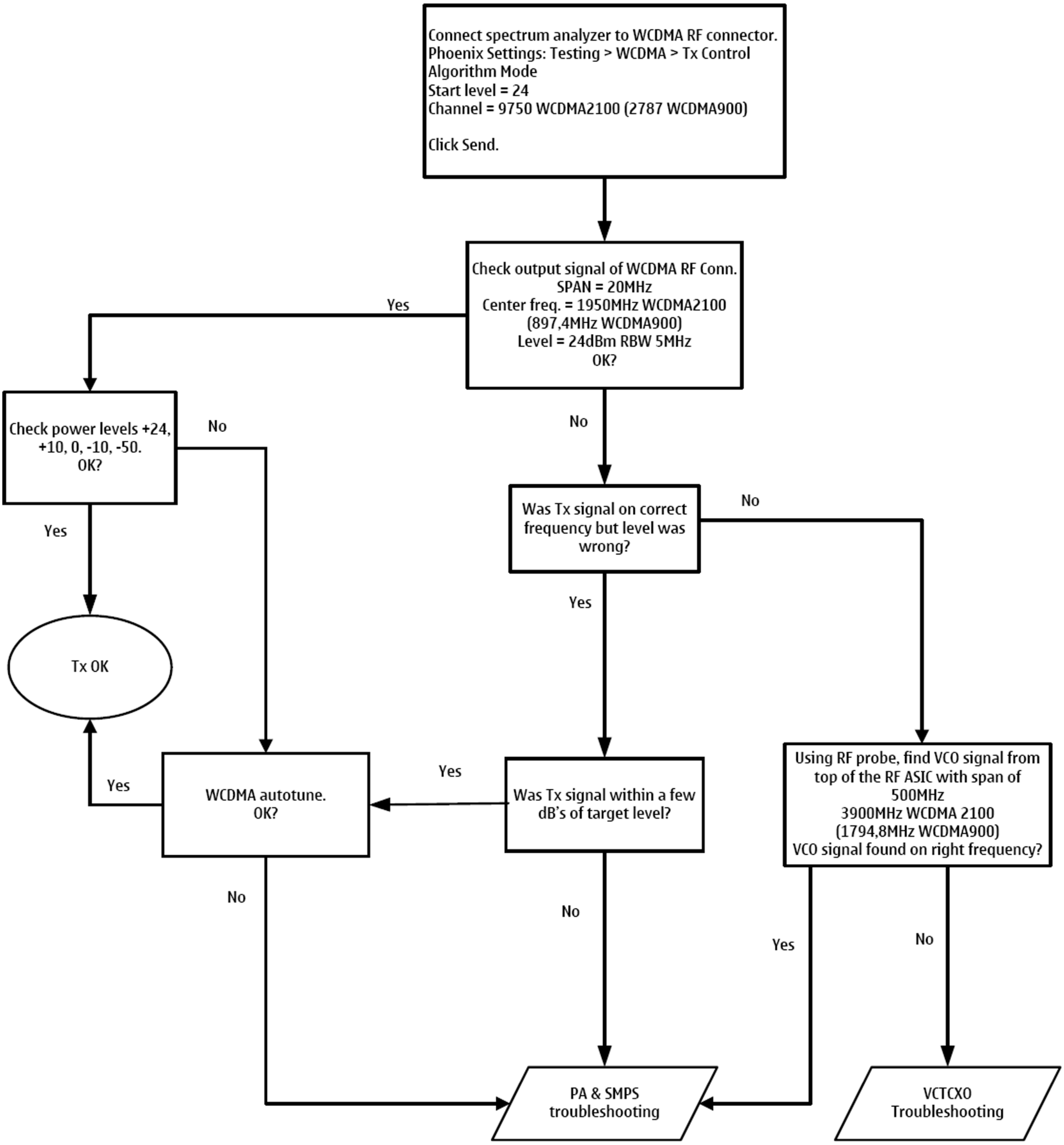
10
Statistic Count

100.00 %
Out of Tolerance

Figure 45 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow


Connect spectrum analyzer to WCDMA RF connector.
Phoenix Settings: Testing > WCDMA > Tx Control
Algorithm Mode
Start level = 24
Channel = 9750 WCDMA2100 (2787 WCDMA900)
Click Send.
Check output signal of WCDMA RF Conn.
SPAN = 20MHz
Center freq. = 1950MHz WCDMA2100
(897,4MHz WCDMA900)
Level = 24dBm RBW 5MHz
OK?
Yes
No
Check power levels +24, +10, 0, -10, -50.
OK?
No
Yes
Was Tx signal on correct frequency but level was wrong?
No
Yes
Tx OK
Using RF probe, find VCO signal from top of the RF ASIC with span of 500MHz
3900MHz WCDMA 2100
(1794,8MHz WCDMA900)
VCO signal found on right frequency?
Yes
WCDMA autotune.
OK?
Yes
Was Tx signal within a few dB's of target level?
No
No
Yes
No
PA & SMPS troubleshooting
VCTCXO Troubleshooting

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

Autotuning for BB5

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRS-6 (RF cable that requires an additional product-specific adapter cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

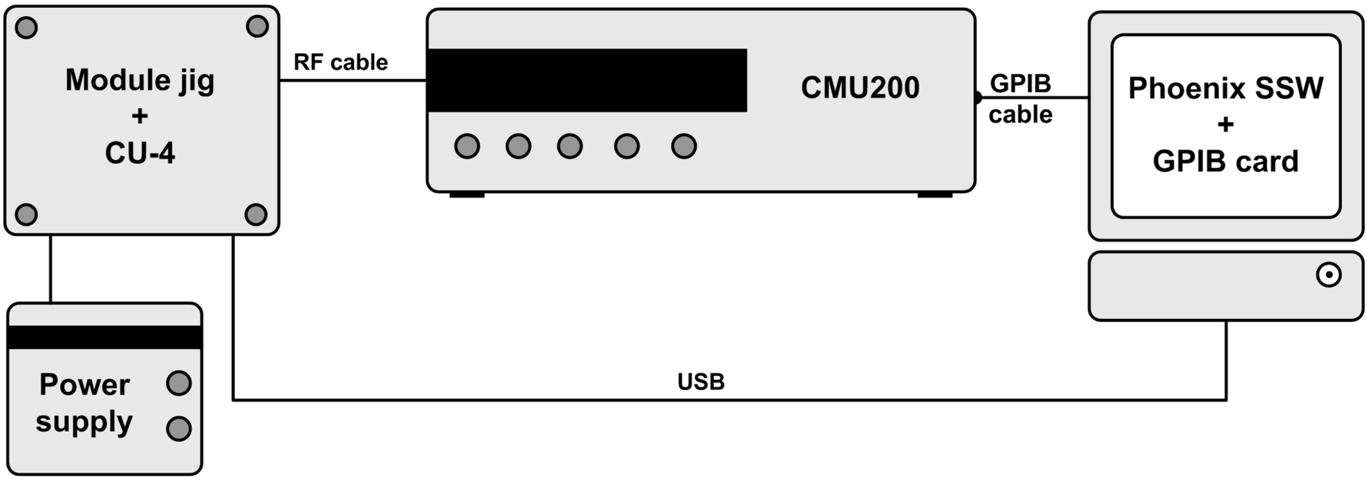


Figure 46 Auto tuning concept with CMU200

Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.
3 Remember to set the correct attenuation values before autotuning.
4 To start autotuning, click the *Tune* button.

System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

Table 12 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results

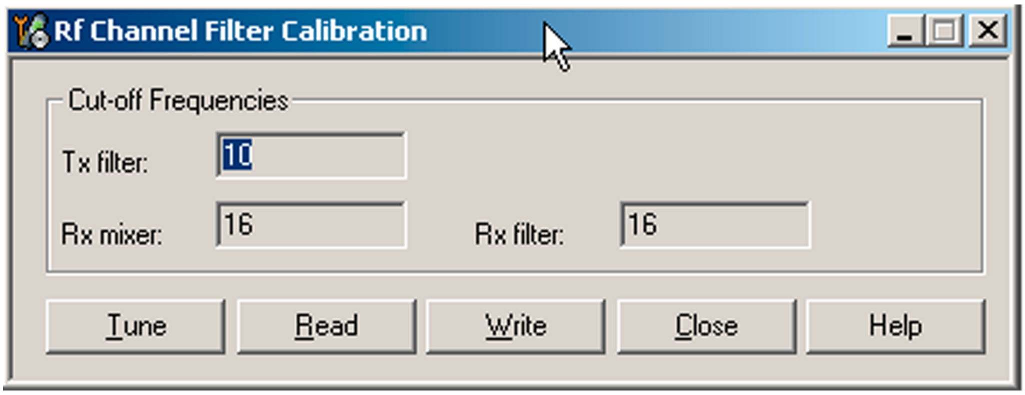

Cut-off Frequencies
Tx filter: 10
Rx mixer: 16
Rx filter: 16

Figure 47 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM receiver tunings

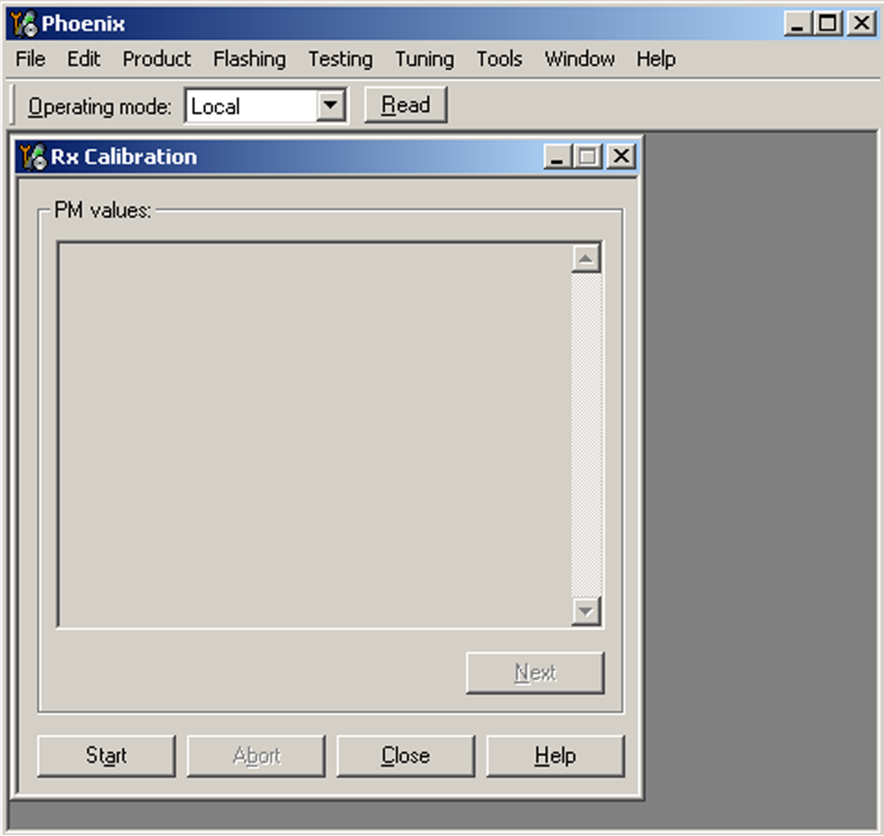
Rx calibration (GSM)

Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

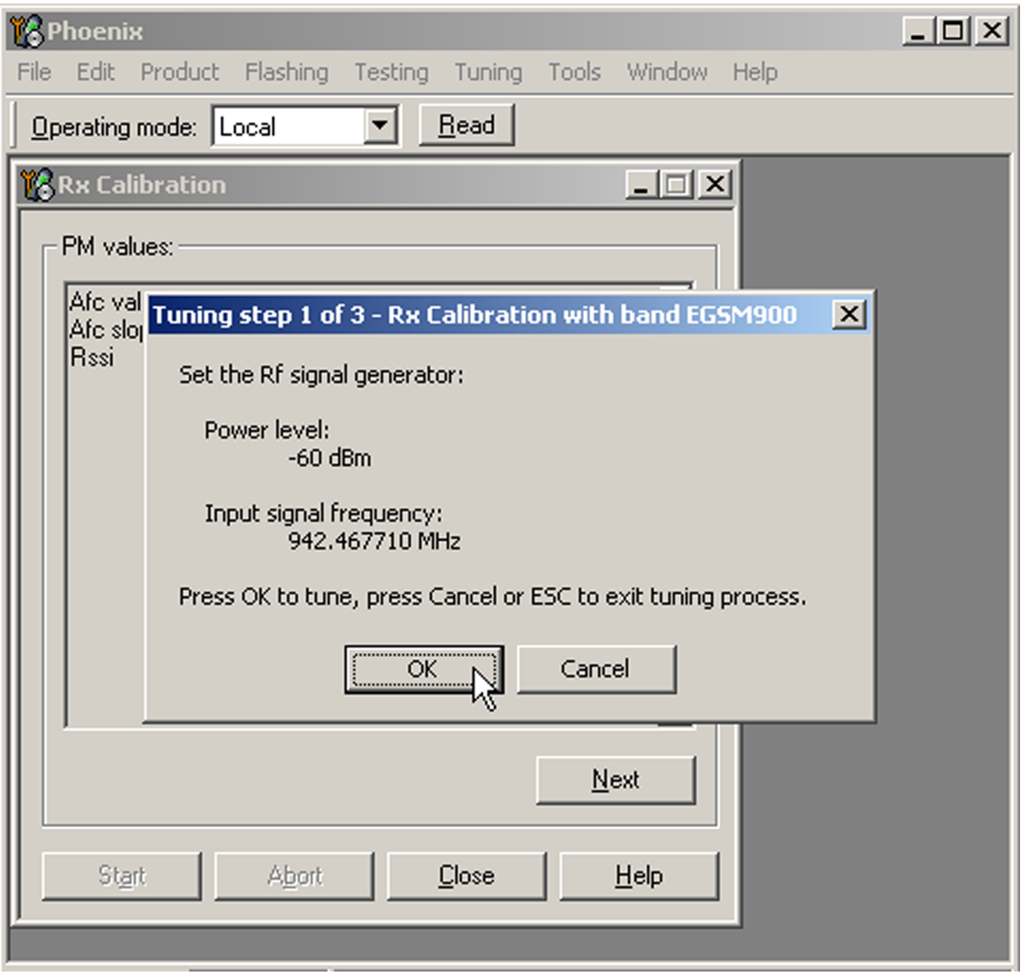
Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .
5. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Next
Start
Abort
Close
Help

6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Afc val
Afc slo
Rssi
Tuning step 1 of 3 - Rx Calibration with band EGSM900
OK
Cancel
Next
Start
Abort
Close
Help

Set the RF signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

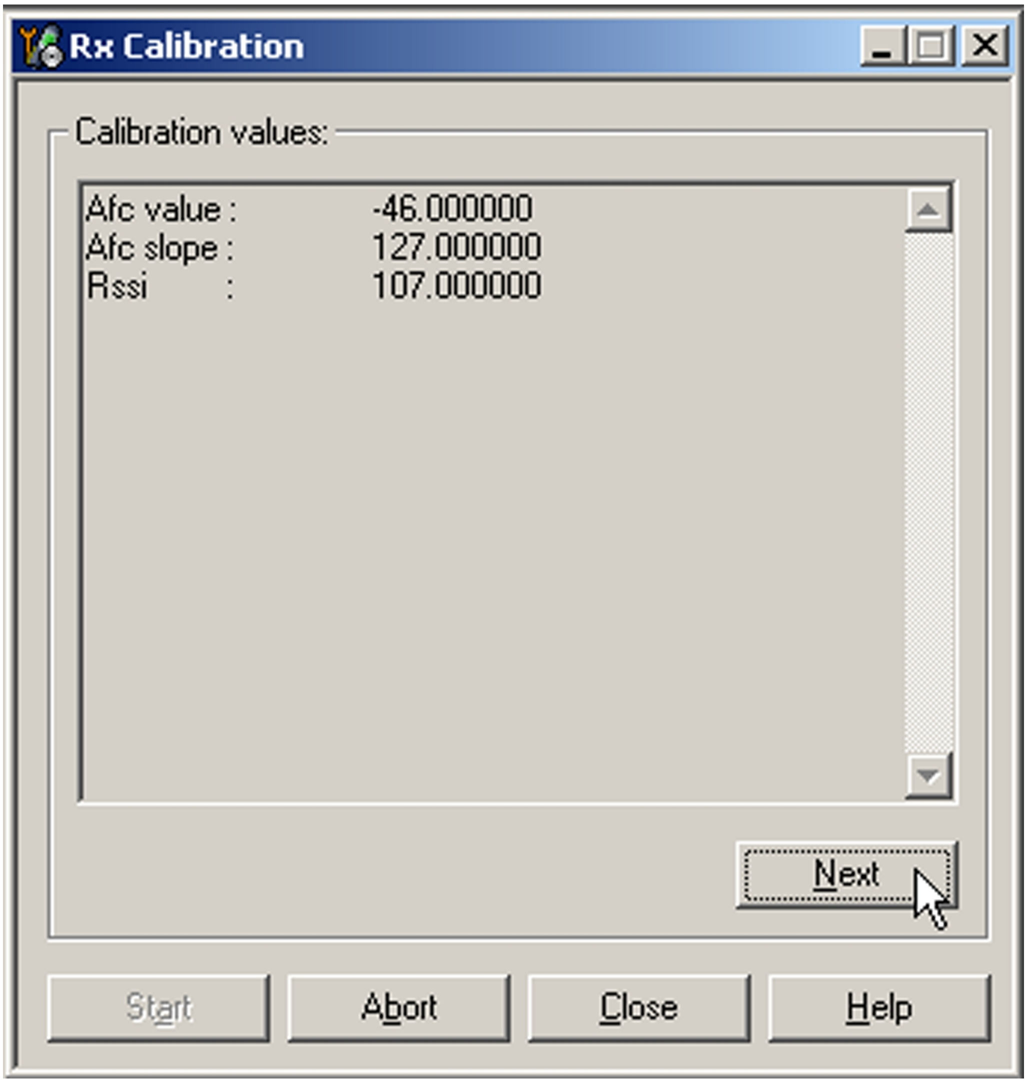
7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 13 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				

	Min	Typ	Max	Unit
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.



Calibration values:

```
Afc value :        -46.000000
Afc slope :        127.000000
Rssi      :        107.000000
```

Next actions

Repeat steps 6 to 9 for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

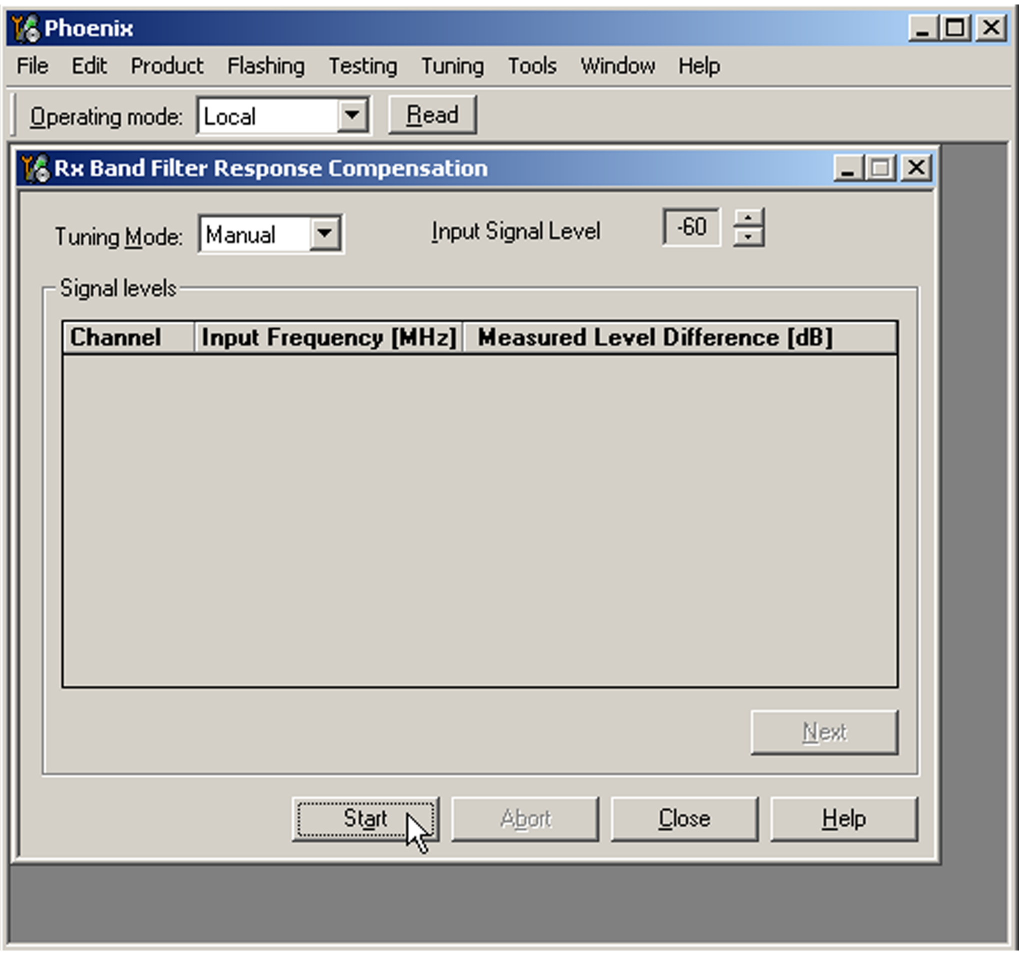
Context

On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Select **GSM900** band.
5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Rx Band Filter Response Compensation
Signal levels
Next
Start
Abort
Close
Help

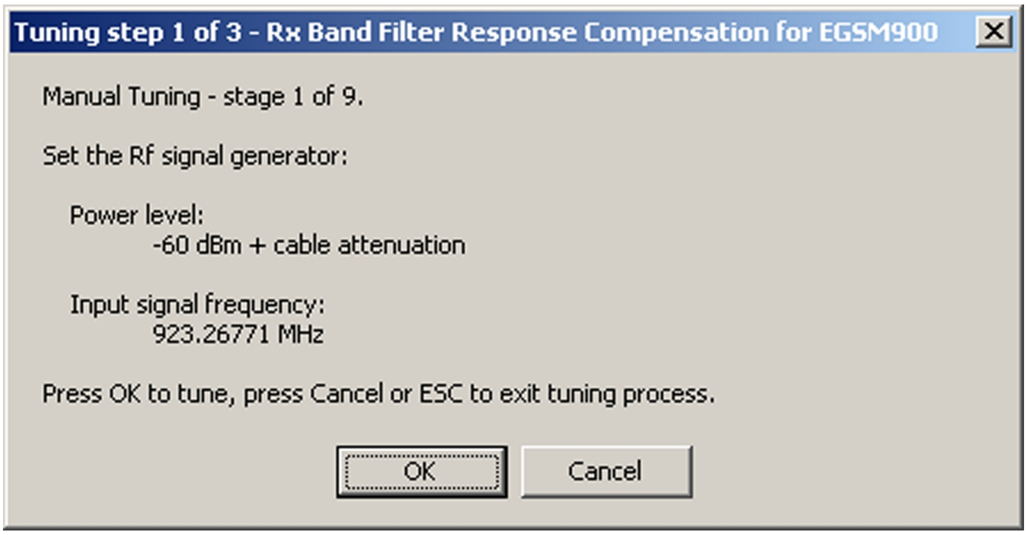
Operating mode: Local

Tuning Mode: Manual

Input Signal Level -60

Channel	Input Frequency [MHz]	Measured Level Difference [dB]

8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.



Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900

Manual Tuning - stage 1 of 9.

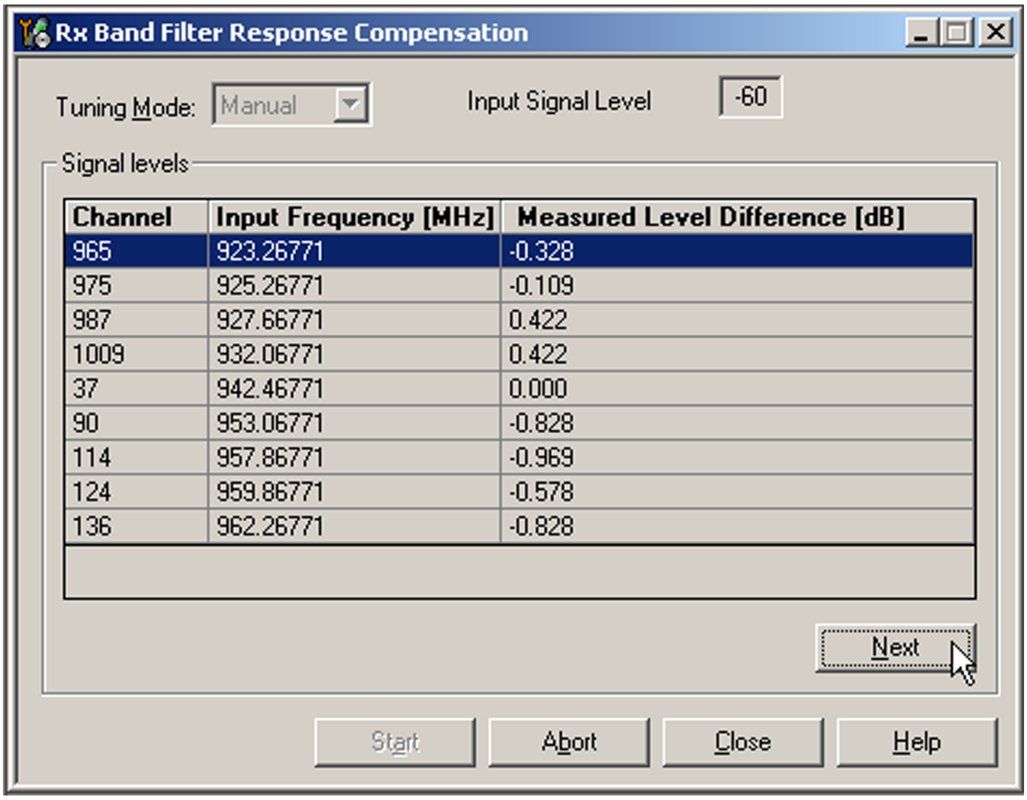
Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



Rx Band Filter Response Compensation

Tuning Mode: Manual

Input Signal Level: -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-0.328
975	925.26771	-0.109
987	927.66771	0.422
1009	932.06771	0.422
37	942.46771	0.000
90	953.06771	-0.828
114	957.86771	-0.969
124	959.86771	-0.578
136	962.26771	-0.828

11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB

	Min	Typ	Max	Unit
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB

	Min	Typ	Max	Unit
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

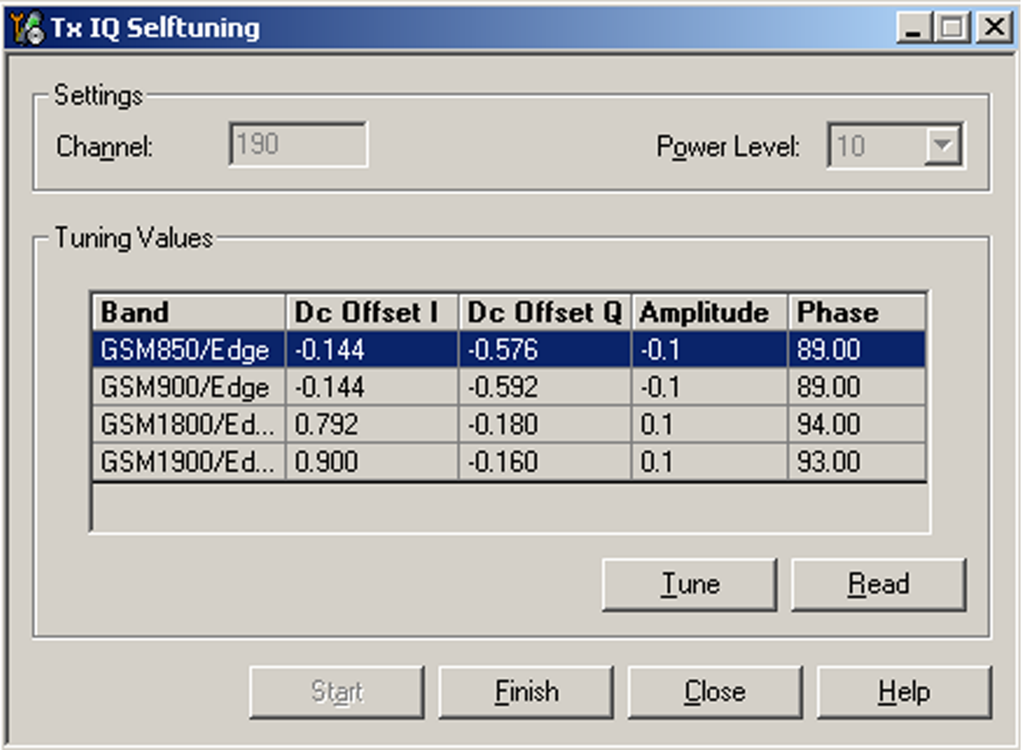
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→GSM→Tx IQ Tuning** .
4. Select **Mode: Automatic**.



Channel: 190

Power Level: 10

Band	Dc Offset I	Dc Offset Q	Amplitude	Phase
GSM850/Edge	-0.144	-0.576	-0.1	89.00
GSM900/Edge	-0.144	-0.592	-0.1	89.00
GSM1800/Ed...	0.792	-0.180	0.1	94.00
GSM1900/Ed...	0.900	-0.160	0.1	93.00

5. Select **Band: GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.

7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

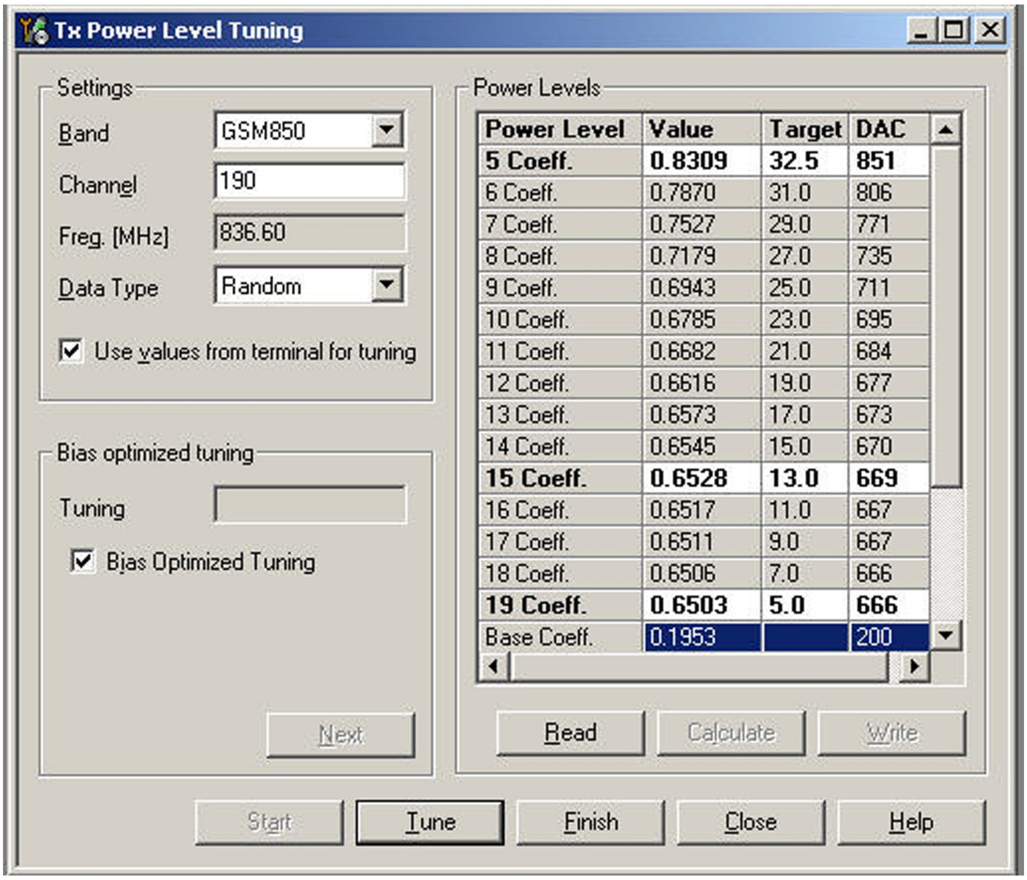
For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning** .

5. Click **Start**.l


Tx Power Level Tuning
Settings
Power Levels
Bias optimized tuning
Next
Read
Calculate
Write
Start
Tune
Finish
Close
Help

Band: GSM850
Channel: 190
Freq. [MHz]: 836.60
Data Type: Random
☑ Use values from terminal for tuning
Tuning:
☑ Bias Optimized Tuning

Power Level	Value	Target	DAC
5 Coeff.	**0.8309**	**32.5**	**851**
6 Coeff.	0.7870	31.0	806
7 Coeff.	0.7527	29.0	771
8 Coeff.	0.7179	27.0	735
9 Coeff.	0.6943	25.0	711
10 Coeff.	0.6785	23.0	695
11 Coeff.	0.6682	21.0	684
12 Coeff.	0.6616	19.0	677
13 Coeff.	0.6573	17.0	673
14 Coeff.	0.6545	15.0	670
15 Coeff.	**0.6528**	**13.0**	**669**
16 Coeff.	0.6517	11.0	667
17 Coeff.	0.6511	9.0	667
18 Coeff.	0.6506	7.0	666
19 Coeff.	**0.6503**	**5.0**	**666**
Base Coeff.	0.1953		200

6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **897.4MHz GSM900** • **1747.8MHz GSM1800** • **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

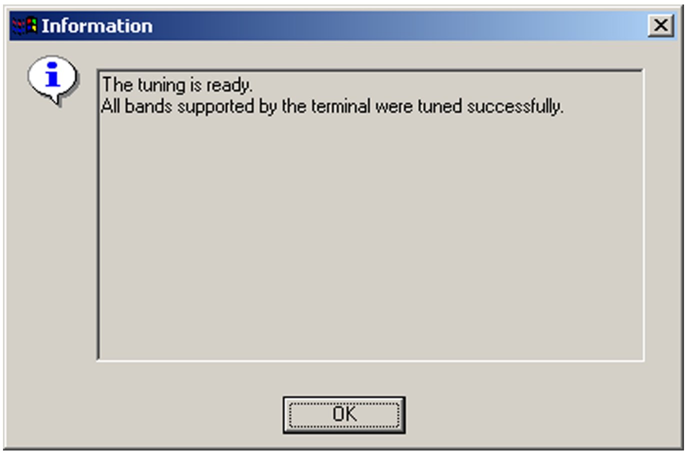
7. Set the tuning targets according to the values in the table below

GMSK	1Slot	2 slot	3 slot
850	32,5	30,2	28,6
900	32,5	30,2	28,6
1800	30	30	28,2
1900	30	30	28,2
EDGE	1Slot	2 slot	3 slot
850	26,5	26,5	24,7
900	26,5	26,5	24,7
1800	25	25	23,2
1900	25	25	23,2
WCDMA Band I	23.5 dBm		
WCDMA Band VIII	24 dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



The tuning is ready.
All bands supported by the terminal were tuned successfully.

WCDMA receiver tunings

RX calibration (WCDMA)

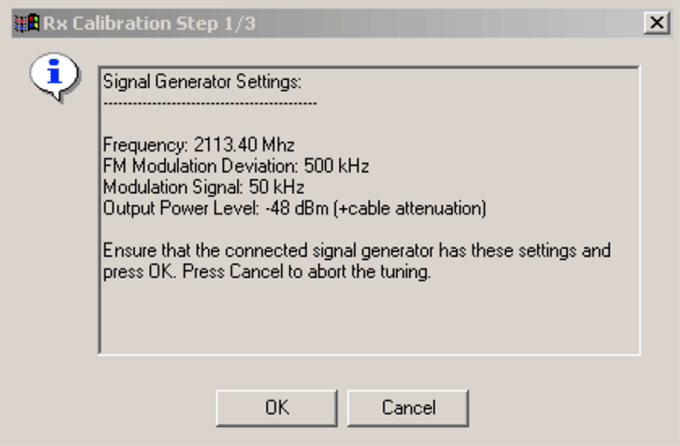
Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA→Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA2100 or WCDMA900".
5. Click **Tune**.
6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.



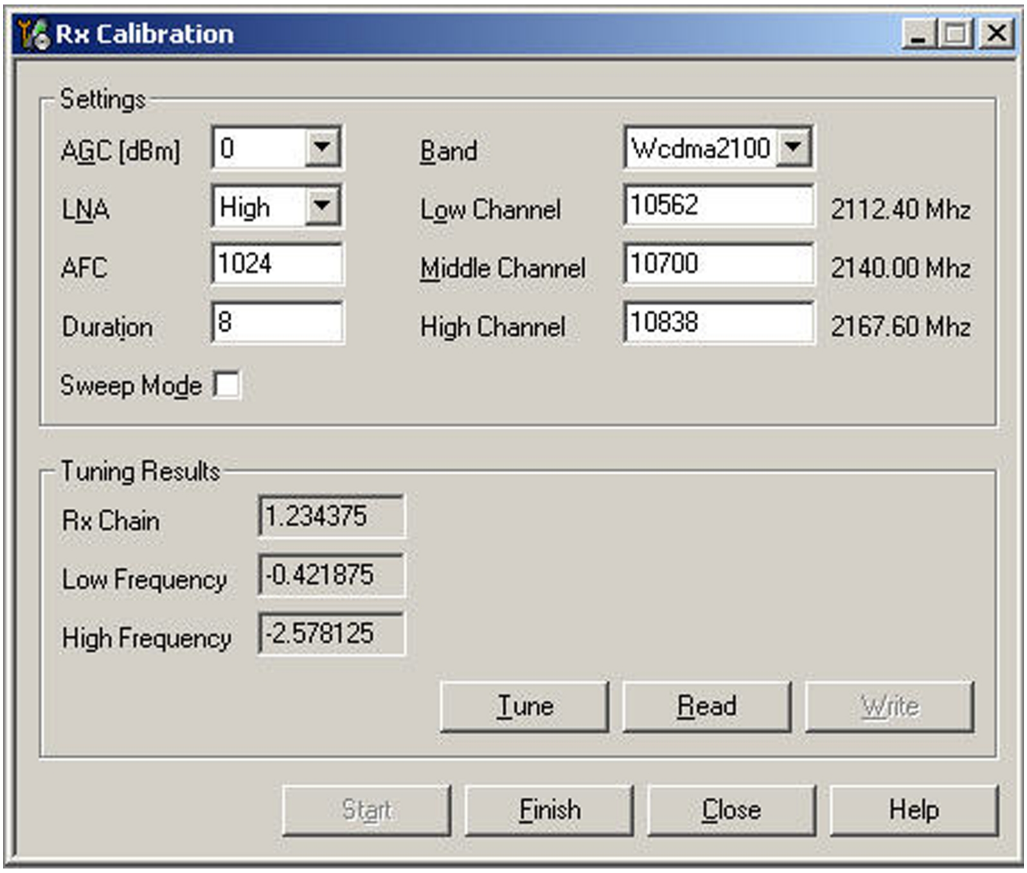
Signal Generator Settings:

Frequency: 2113.40 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 48 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



Settings

AGC [dBm]: 0

LNA: High

AFC: 1024

Duration: 8

Sweep Mode ☐

Band: Wcdma2100

Low Channel: 10562 2112.40 Mhz

Middle Channel: 10700 2140.00 Mhz

High Channel: 10838 2167.60 Mhz

Tuning Results

Rx Chain: 1.234375

Low Frequency: -0.421875

High Frequency: -2.578125

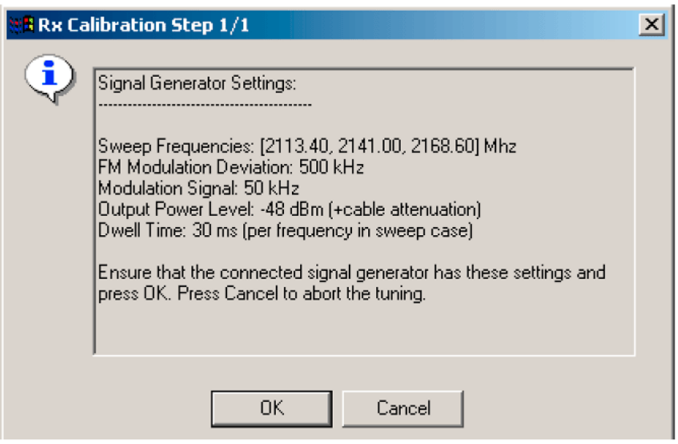
8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	2100 or 900	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA→ Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA2100 or WCDMA900".
- Check the **Sweep Mode** box.
- Click **Tune**.

- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.



Signal Generator Settings:

Sweep Frequencies: [2113.40, 2141.00, 2168.60] Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)
Dwell Time: 30 ms (per frequency in sweep case)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 49 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

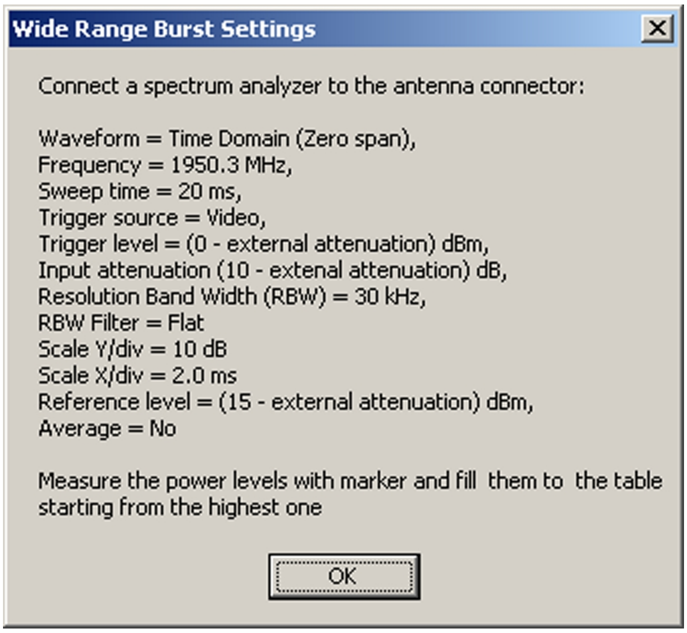
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see *Alternative steps*.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).

5. Set up the spectrum analyzer in the following way:



Connect a spectrum analyzer to the antenna connector:

Waveform = Time Domain (Zero span),
Frequency = 1950.3 MHz,
Sweep time = 20 ms,
Trigger source = Video,
Trigger level = (0 - external attenuation) dBm,
Input attenuation (10 - extenal attenuation) dB,
Resolution Band Width (RBW) = 30 kHz,
RBW Filter = Flat
Scale Y/div = 10 dB
Scale X/div = 2.0 ms
Reference level = (15 - external attenuation) dBm,
Average = No

Measure the power levels with marker and fill them to the table starting from the highest one

6. After setting the spectrum analyzer, click **OK**.
7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1250 us and so on for every 500 us until the table is filled.

   > **Note:** It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.
   >
   > Make sure that the marker is not measuring the level of noise spikes on lower levels.

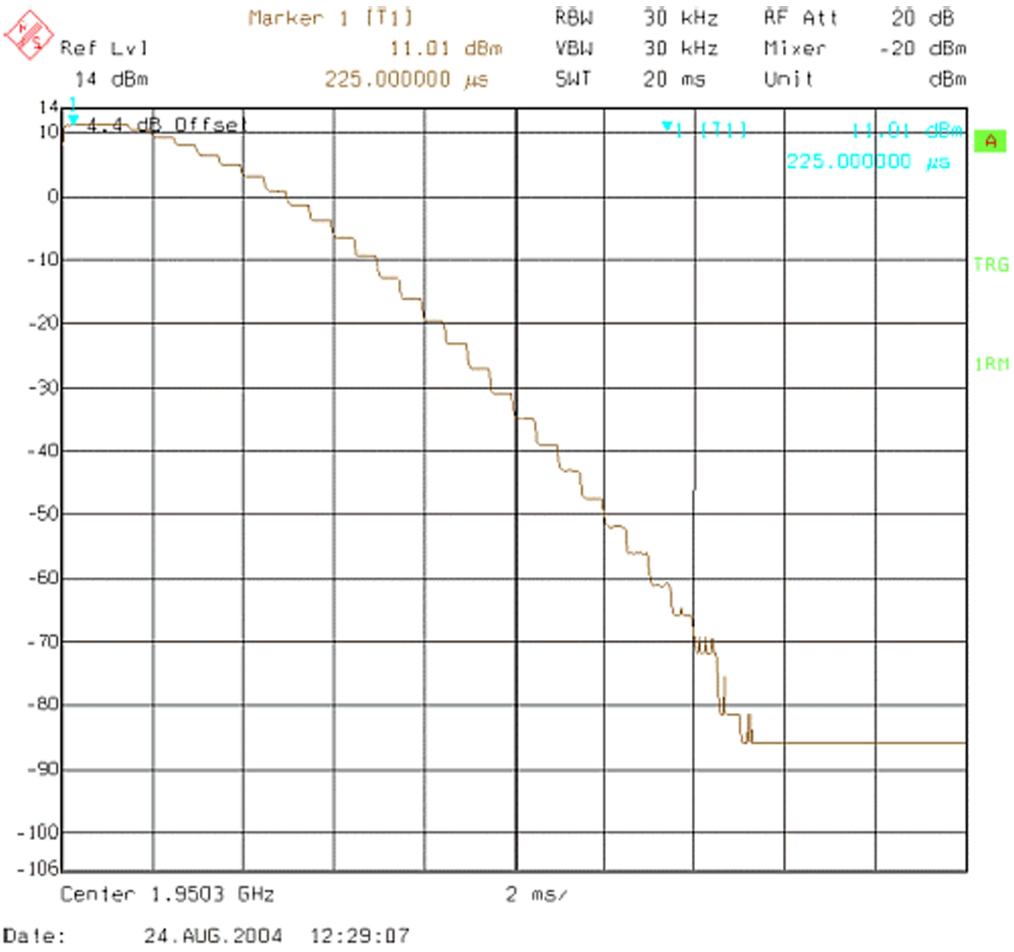
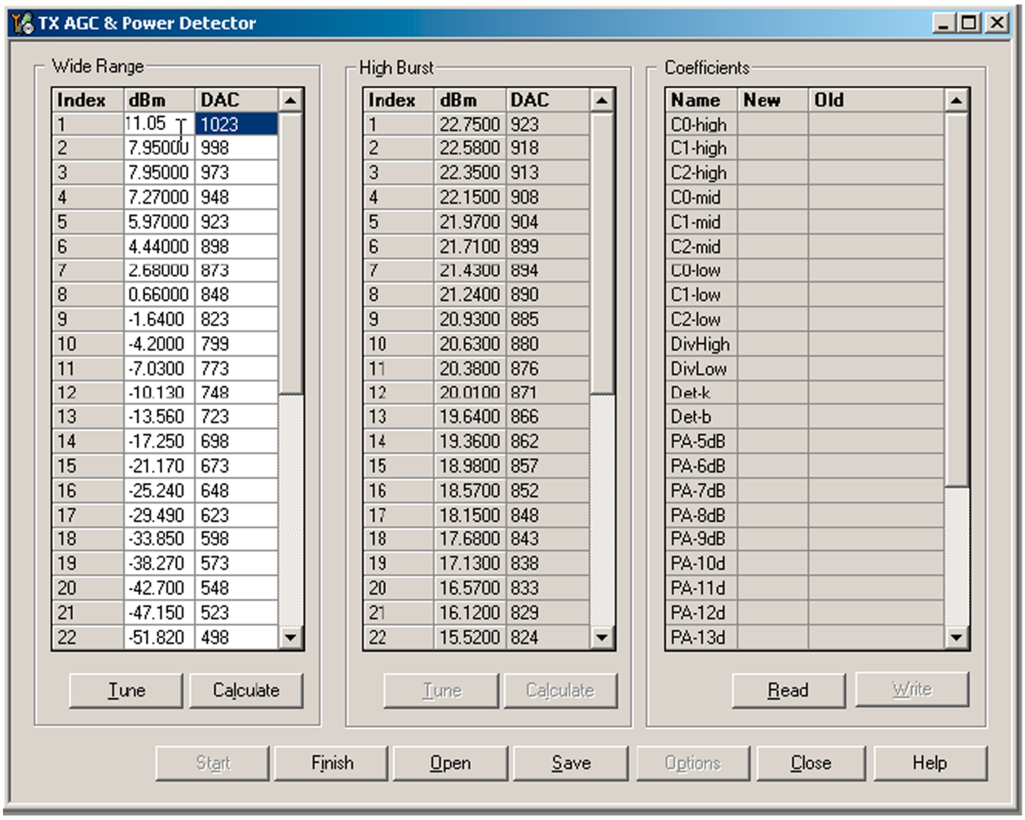


Figure 50 WCDMA power level tuning steps

8. Fill in the power level values (in dBm) to the *Wide Range* table.


TX AGC & Power Detector
Wide Range
High Burst
Coefficients
Tune
Calculate
Tune
Calculate
Read
Write
Start
Finish
Open
Save
Options
Close
Help

Wide Range

Index	dBm	DAC
1	11.05	1023
2	7.95000	998
3	7.95000	973
4	7.27000	948
5	5.97000	923
6	4.44000	898
7	2.68000	873
8	0.66000	848
9	-1.6400	823
10	-4.2000	799
11	-7.0300	773
12	-10.130	748
13	-13.560	723
14	-17.250	698
15	-21.170	673
16	-25.240	648
17	-29.490	623
18	-33.850	598
19	-38.270	573
20	-42.700	548
21	-47.150	523
22	-51.820	498

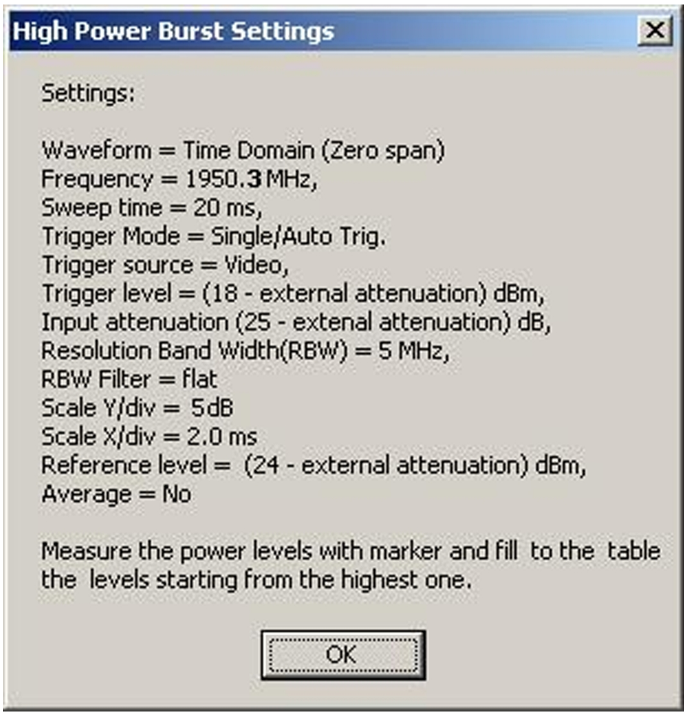
High Burst

Index	dBm	DAC
1	22.7500	923
2	22.5800	918
3	22.3500	913
4	22.1500	908
5	21.9700	904
6	21.7100	899
7	21.4300	894
8	21.2400	890
9	20.9300	885
10	20.6300	880
11	20.3800	876
12	20.0100	871
13	19.6400	866
14	19.3600	862
15	18.9800	857
16	18.5700	852
17	18.1500	848
18	17.6800	843
19	17.1300	838
20	16.5700	833
21	16.1200	829
22	15.5200	824

Coefficients

Name	New	Old
C0-high		
C1-high		
C2-high		
C0-mid		
C1-mid		
C2-mid		
C0-low		
C1-low		
C2-low		
DivHigh		
DivLow		
Det-k		
Det-b		
PA-5dB		
PA-6dB		
PA-7dB		
PA-8dB		
PA-9dB		
PA-10d		
PA-11d		
PA-12d		
PA-13d		

9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:


High Power Burst Settings
OK

Settings:

Waveform = Time Domain (Zero span)
Frequency = 1950.3 MHz,
Sweep time = 20 ms,
Trigger Mode = Single/Auto Trig.
Trigger source = Video,
Trigger level = (18 - external attenuation) dBm,
Input attenuation (25 - extenal attenuation) dB,
Resolution Band Width(RBW) = 5 MHz,
RBW Filter = flat
Scale Y/div = 5dB
Scale X/div = 2.0 ms
Reference level = (24 - external attenuation) dBm,
Average = No

Measure the power levels with marker and fill to the table the levels starting from the highest one.

12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

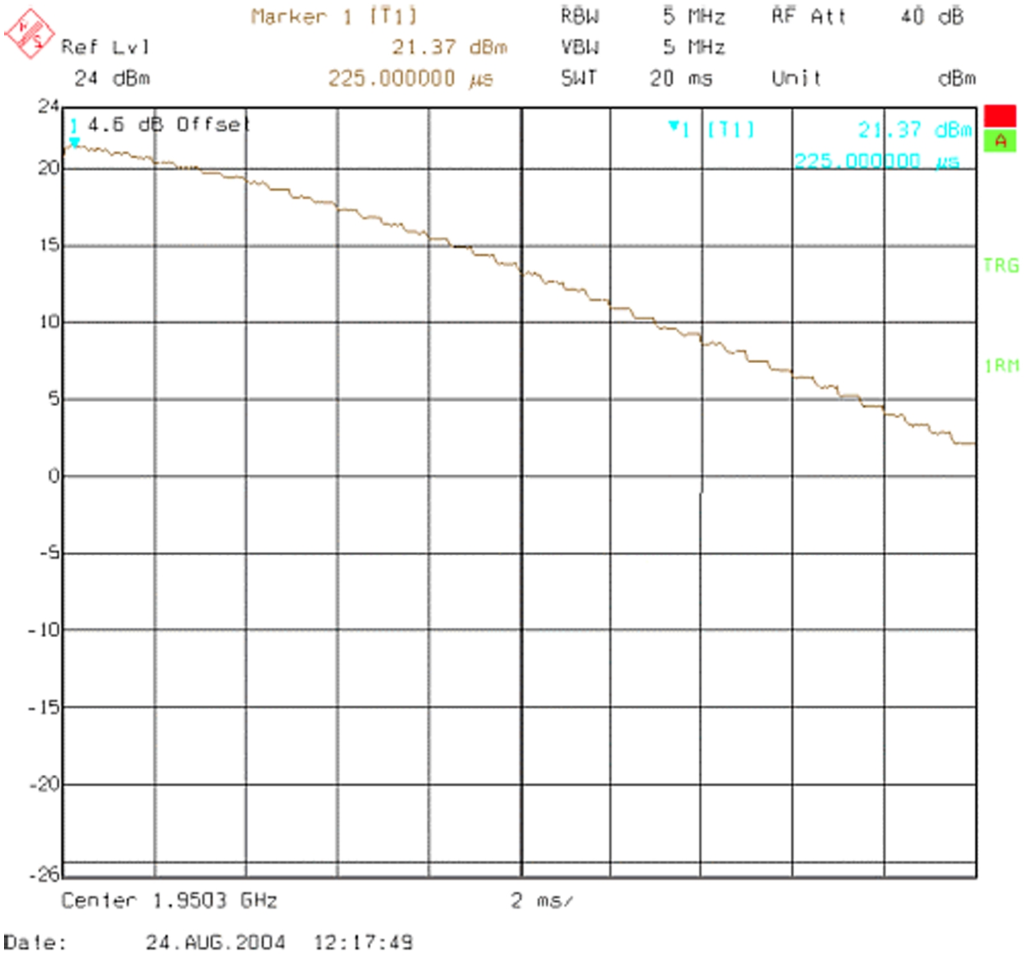

Marker 1 [T1]
21.37 dBm
225.000000 µs
Ref Lvl
24 dBm
RBW 5 MHz
VBW 5 MHz
SWT 20 ms
RF Att 40 dB
Unit dBm
1 4.6 dB Offset
▼1 [T1]
21.37 dBm
225.000000 µs
A
TRG
1RM
24
20
15
10
5
0
-5
-10
-15
-20
-26
Center 1.9503 GHz
2 ms/
Date: 24.AUG.2004 12:17:49

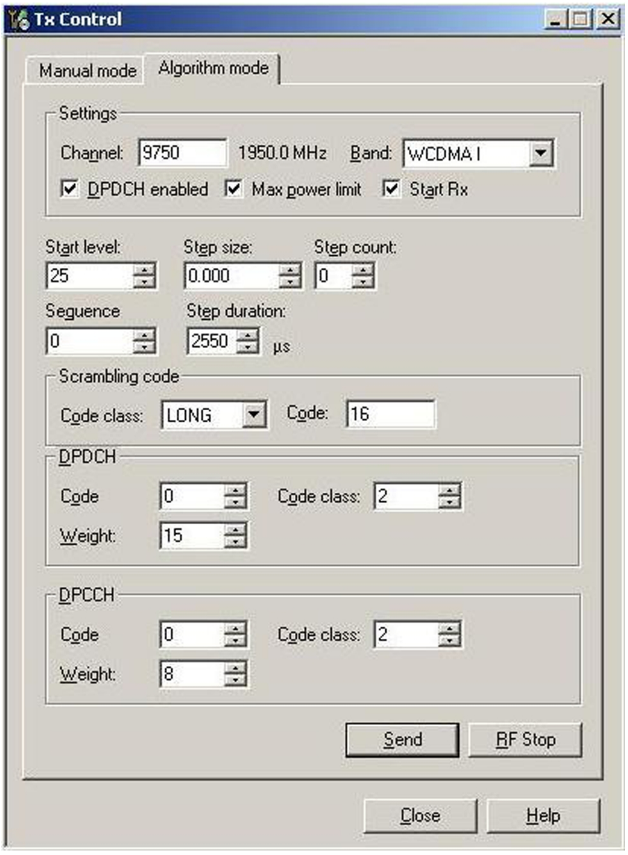
Figure 51 High burst measurement

13. In the *High Burst* pane, click **Calculate**.
14. Check that the calculated values are within the limits specified in the following table:

	Min	Max
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing→WCDMA→ Tx Control.**
18. Select the *Algorithm* mode tab.



Settings
Channel: 9750 1950.0 MHz Band: WCDMA I
☑ DPDCH enabled ☑ Max power limit ☑ Start Rx
Start level: 25
Step size: 0.000
Step count: 0
Sequence 0
Step duration: 2550 µs
Scrambling code
Code class: LONG Code: 16
DPDCH
Code 0 Code class: 2
Weight: 15
DPCCH
Code 0 Code class: 2
Weight: 8

19. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950.3MHz (WCDMA I)** or **897.4MHz (WCDMA VIII)**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz

Sweep time:	20 ms
Detector:	**RMS detector**
Average:	No
Trigger:	Free run

21. Click **Send**.
22. Measure the WCDMA output power.

    It should be around 21 dBm.
23. Click **RF Stop** and uncheck the **Max power limit** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

    The measured output power may not differ more than +-2 dB from the requested value at level +19 dBm and no more than +-4 dB on lower levels.

    Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click **Finish**.
- Click **Options**.
- Change the first wide range DAC value to 573 and change the number of tuning steps to 21.
- Change the spectrum analyzer reference level to –20 dBm and adjust the input attenuator to the lowest value possible.
- In the *Wide Range* pane, click **Tune** and fill in the rest of values starting from the 19th level.

Tx band response calibration (WCDMA)

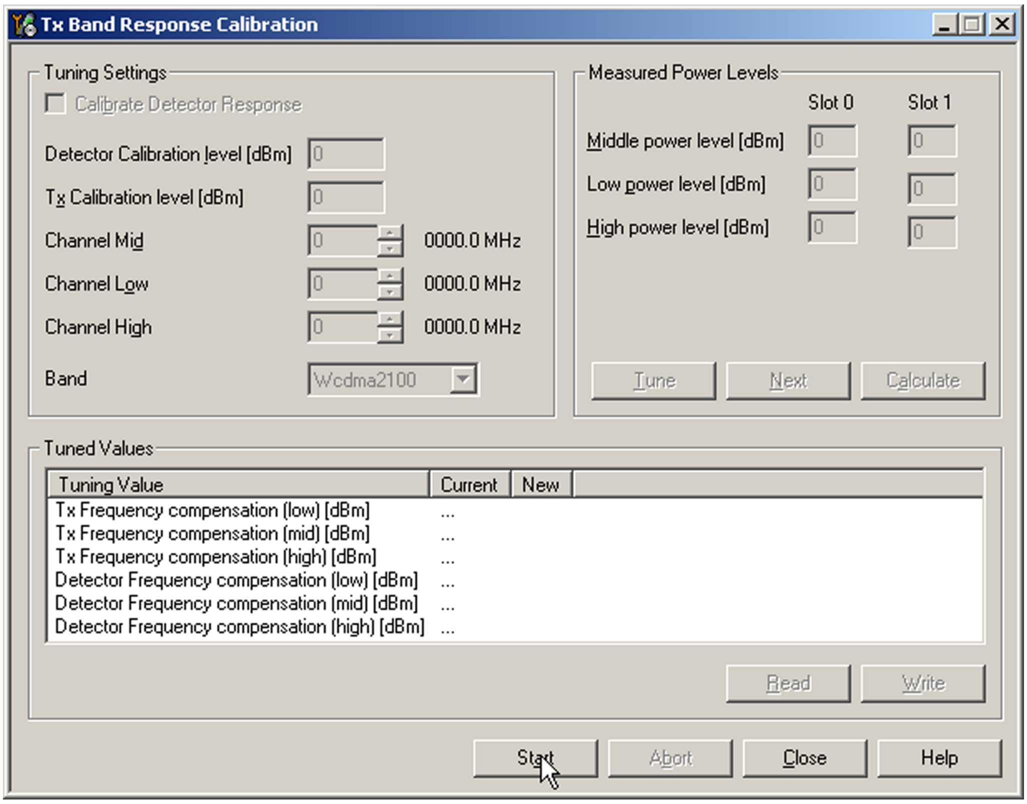
Context

The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In the *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In the *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- The **Abort** button aborts the tuning operation without saving the tuned values.
- The **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.
2. Choose **File→Scan Product** .
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→WCDMA→Tx Band Response Calibration** .
5. Click **Start**.



Detector Calibration level [dBm] 0
Tx Calibration level [dBm] 0
Channel Mid 0 0000.0 MHz
Channel Low 0 0000.0 MHz
Channel High 0 0000.0 MHz
Band Wcdma2100

	Slot 0	Slot 1
Middle power level [dBm]	0	0
Low power level [dBm]	0	0
High power level [dBm]	0	0

Tuning Value	Current	New
Tx Frequency compensation (low) [dBm]	...	
Tx Frequency compensation (mid) [dBm]	...	
Tx Frequency compensation (high) [dBm]	...	
Detector Frequency compensation (low) [dBm]	...	
Detector Frequency compensation (mid) [dBm]	...	
Detector Frequency compensation (high) [dBm]	...	

The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.
7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.
8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

   Slot 0 is used for detector calibration and slot 1 for Tx calibration.
9. Click **Next**.
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next**.
15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes**.

	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

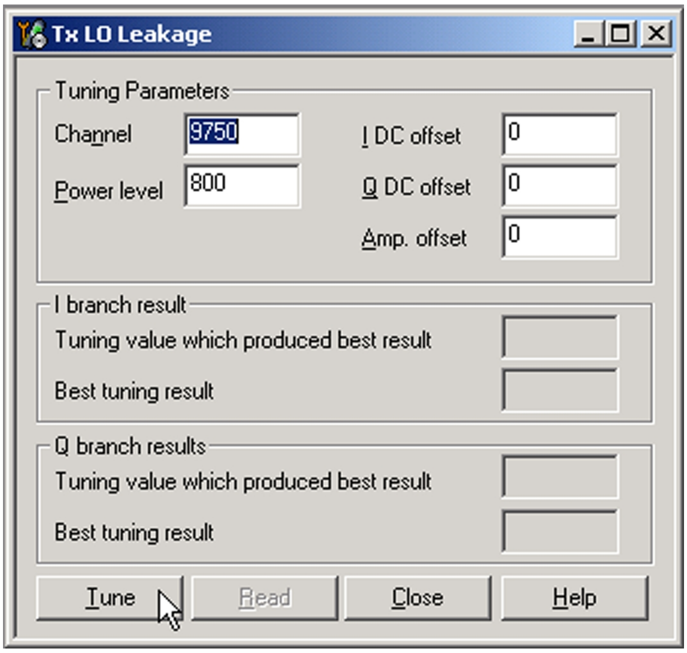
Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→ Tx LO Leakage** .
3. Click **Tune**.



Channel 9750
Power level 800
I DC offset 0
Q DC offset 0
Amp. offset 0

Tx LO Leakage
Tuning Parameters
I branch result
Tuning value which produced best result
Best tuning result
Q branch results
Tuning value which produced best result
Best tuning result
Tune
Read
Close
Help

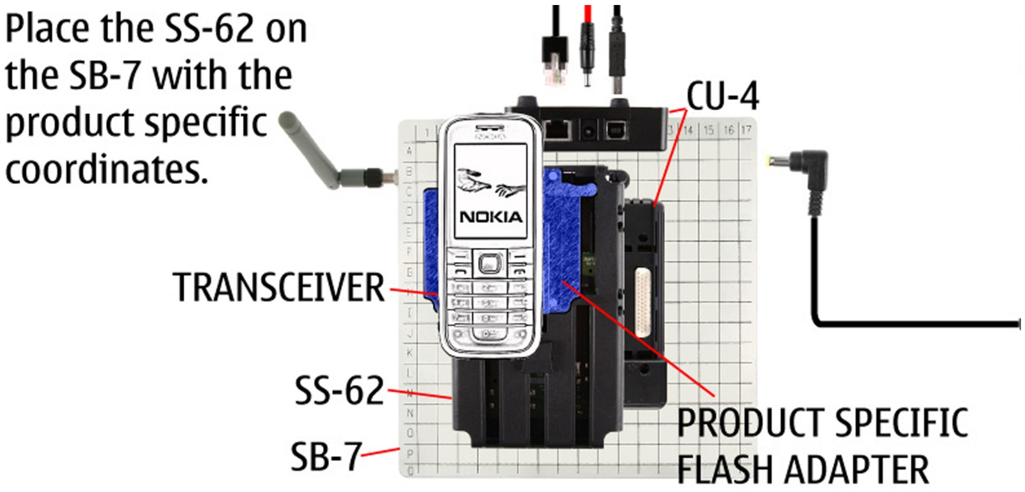
4. To end the tuning, click **Close**.

WLAN troubleshooting

WLAN functionality test using SB-7 and Phoenix

Steps

1. Place the phone on the SB-7 WLAN test box (see figure below). The co-ordinates are A1 (for the upper left foot).



Place the SS-62 on the SB-7 with the product specific coordinates.

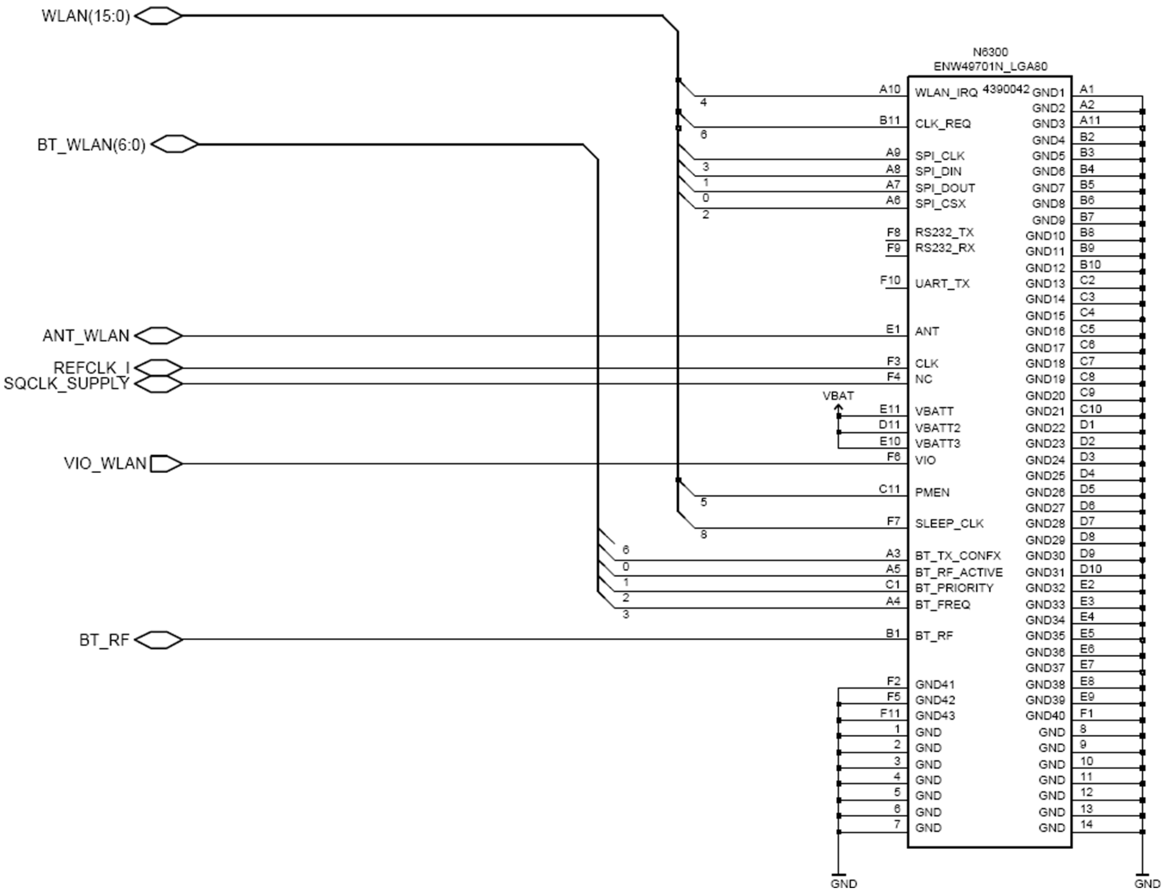
2. Start the phone to normal or offline (RF inactive) mode.
3. Search for SB-7 WLAN test box via the phone's **Operator** menu. Go to **Menu**→**Oper. menu**, and the *Select connection* pop-up window appears. Select **Search for WLAN**. If the phone is in offline mode, select Yes when the question *Create WLAN connection in offline mode?* pops up.
4. Select the default WLAN network. WLAN connects to the SB-7 access point, which is named "default". You will receive a *Web: no gateway reply* error message, because the internet is not accessible through SB-7. However, you are now connected to SB-7.
5. Check the signal level from the **Connection Manager** menu. Go to **Menu**→**Crtl. panel**→**Connectivity**→**Connection Mgr.**. You should see the "default" connection in the connection list with the connection time running. Go to **Options**→**Details**. Observe the signal strength. "Signal" should show a signal strength Medium (50%) or higher.

   Note: Local WLAN environment may affect test results, especially if there are many WLAN access points nearby and any of them are using the same WLAN channel as SB-7. If you have problems performing the test, consider repeating the test where local networks do not interfere with the lower strength signal of the SB-7 box.

   If you still cannot find the WLAN test box name "default" after scanning the networks, or if you have connected to the test box but signal strength is lower that 50%, the phone is not ok. In that case, proceed to WLAN failure troubleshooting.

WLAN layout and test points

The WLAN module has been optimised to achieve the smallest possible PWB area and adding test points will compromise this layout efficiency. There is also an added risk that test point will compromise the WLAN performance. Therefore there are no test points in the WLAN layout. Software tests will be used instead to verify the operation of the WLAN module. The WLAN schematic is provided below.


WLAN(15:0)
BT_WLAN(6:0)
ANT_WLAN
REFCLK_I
SQCLK_SUPPLY
VIO_WLAN
BT_RF
VBAT
N6300
ENW49701N_LGA80
4390042
A10 WLAN_IRQ
B11 CLK_REQ
A9 SPI_CLK
A8 SPI_DIN
A7 SPI_DOUT
A6 SPI_CSX
F8 RS232_TX
F9 RS232_RX
F10 UART_TX
E1 ANT
F3 CLK
F4 NC
E11 VBATT
D11 VBATT2
E10 VBATT3
F6 VIO
C11 PMEN
F7 SLEEP_CLK
A3 BT_TX_CONFX
A5 BT_RF_ACTIVE
C1 BT_PRIORITY
A4 BT_FREQ
B1 BT_RF
F2 GND41
F5 GND42
F11 GND43
GND1–GND40
GND
GND

WLAN self tests

Context

The sequence of events during the start-up of WLAN is:

1 PMEN is asserted high when the WLAN module is first enabled by the Host.

2 WLAN module should respond by driving CLK REQ high to request the 38.4MHz clock.

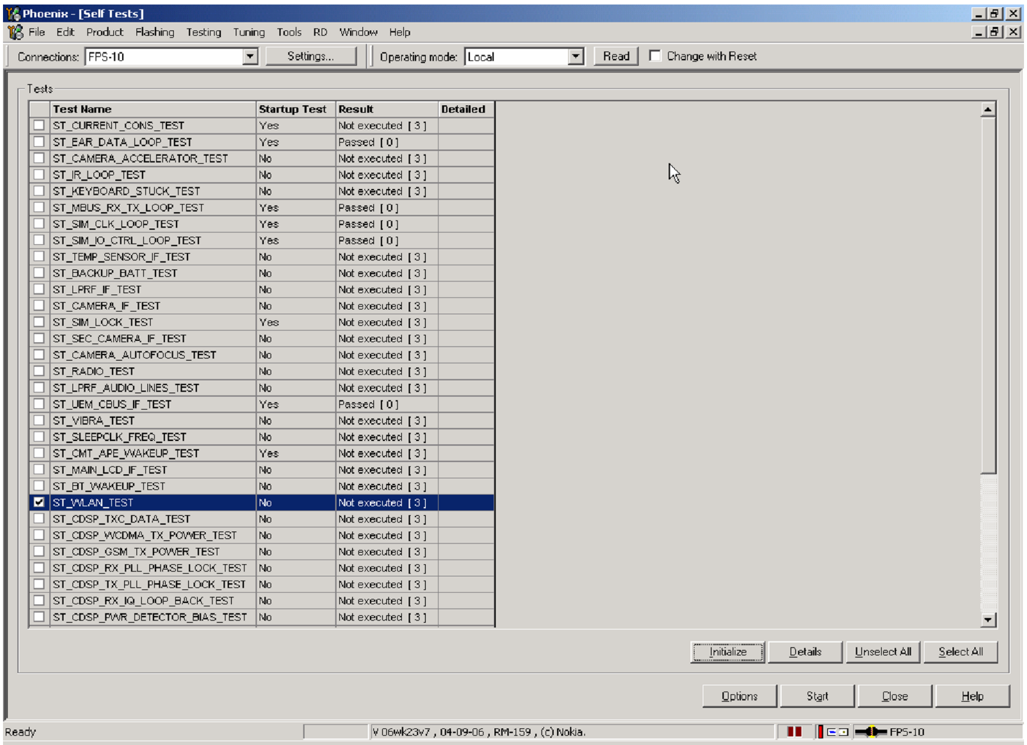
3 Host engine turns on the 38.4MHz clock and then generates the SPI Clock to start the download of software to the WLAN module.

The steps for running the WLAN self tests with Phoenix are listed below.

Steps

1. Set the phone into Local Mode .
2. From the **File** menu, select Scan Product and check that the correct product version is displayed.
3. From the **Testing** menu, select Self Tests. This opens up a Self Test dialogue box, as shown below.

   Select the ST_WLAN_TEST check box as shown and then click on the **Start** button. The test turns on the WLAN, sets up the SPI interface and then downloads the WLAN firmware into the WLAN module. During the download the WLAN acknowledges the data blocks and so the self test is a good way to confirm that the WLAN module is communicating with the Host. The result column will change to **Passed** after a few seconds if operating properly.


Phoenix - [Self Tests]
File
Edit
Product
Flashing
Testing
Tuning
Tools
RD
Window
Help
Settings...
Read
Change with Reset
Tests
Initialize
Details
Unselect All
Select All
Options
Start
Close
Help
FPS-10

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_CAMERA_ACCELERATOR_TEST	No	Not executed [3]	
☐	ST_IR_LOOP_TEST	No	Not executed [3]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_MBUS_RX_TX_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_TEMP_SENSOR_IF_TEST	No	Not executed [3]	
☐	ST_BACKUP_BATT_TEST	No	Not executed [3]	
☐	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☐	ST_SEC_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☑	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	

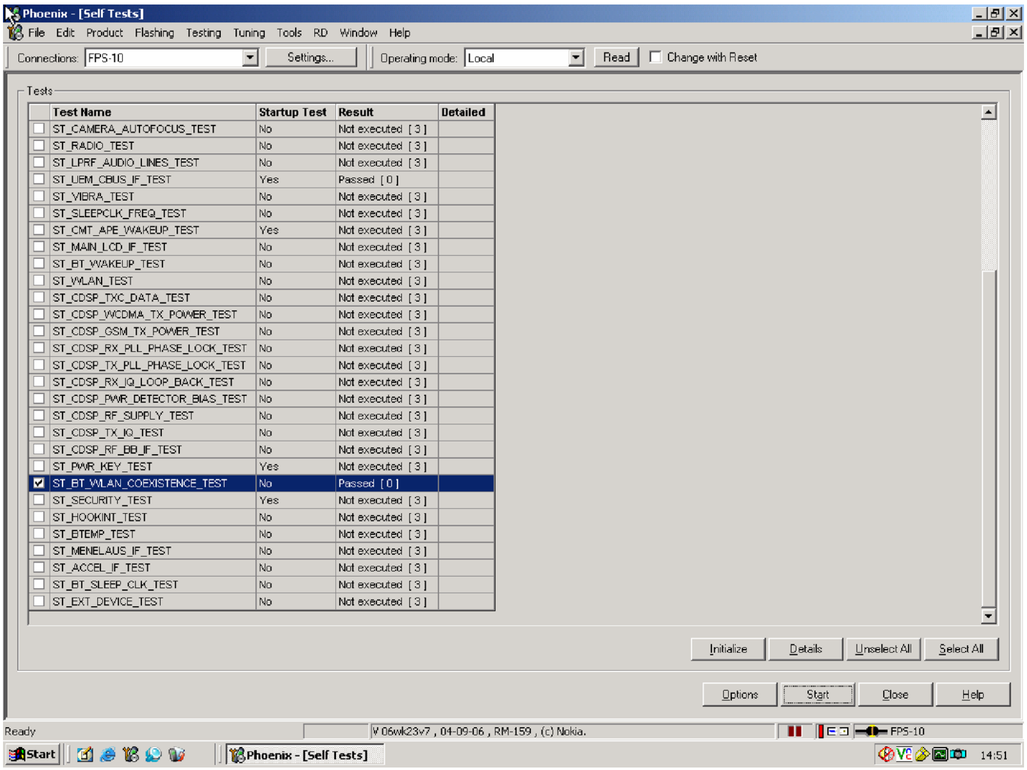
Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

In addition, a test of the WLAN to BT interface can be done by selecting the ST_BT_WLAN_COEXISTENCE_TEST check box and clicking the **Start** button.

This test verifies that the WLAN to BT co-existence interface signals are properly connected and there are no open circuit or shorts on the four interface signals.

The co-existence interface comprises BT Txconfig, BT RF Active, BT Priority, and BT Frequency.


Phoenix - [Self Tests]
File
Edit
Product
Flashing
Testing
Tuning
Tools
RD
Window
Help
Settings...
Read
Change with Reset
Tests
Initialize
Details
Unselect All
Select All
Options
Start
Close
Help
FPS-10
Start
Phoenix - [Self Tests]
14:51

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

	Test Name	Startup Test	Result	Detailed
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_SUPPLY_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_IQ_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_BB_IF_TEST	No	Not executed [3]	
☐	ST_PWR_KEY_TEST	Yes	Not executed [3]	
☑	ST_BT_WLAN_COEXISTENCE_TEST	No	Passed [0]	
☐	ST_SECURITY_TEST	Yes	Not executed [3]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	
☐	ST_BTEMP_TEST	No	Not executed [3]	
☐	ST_MENELAUS_IF_TEST	No	Not executed [3]	
☐	ST_ACCEL_IF_TEST	No	Not executed [3]	
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]	
☐	ST_EXT_DEVICE_TEST	No	Not executed [3]	

Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

The two self tests described above provide a simple means of ensuring the Host engine is able to communicate with the WLAN module and check the interface to BT. A more detailed WLAN performance test is covered in WLAN functional test section.

WLAN functional tests

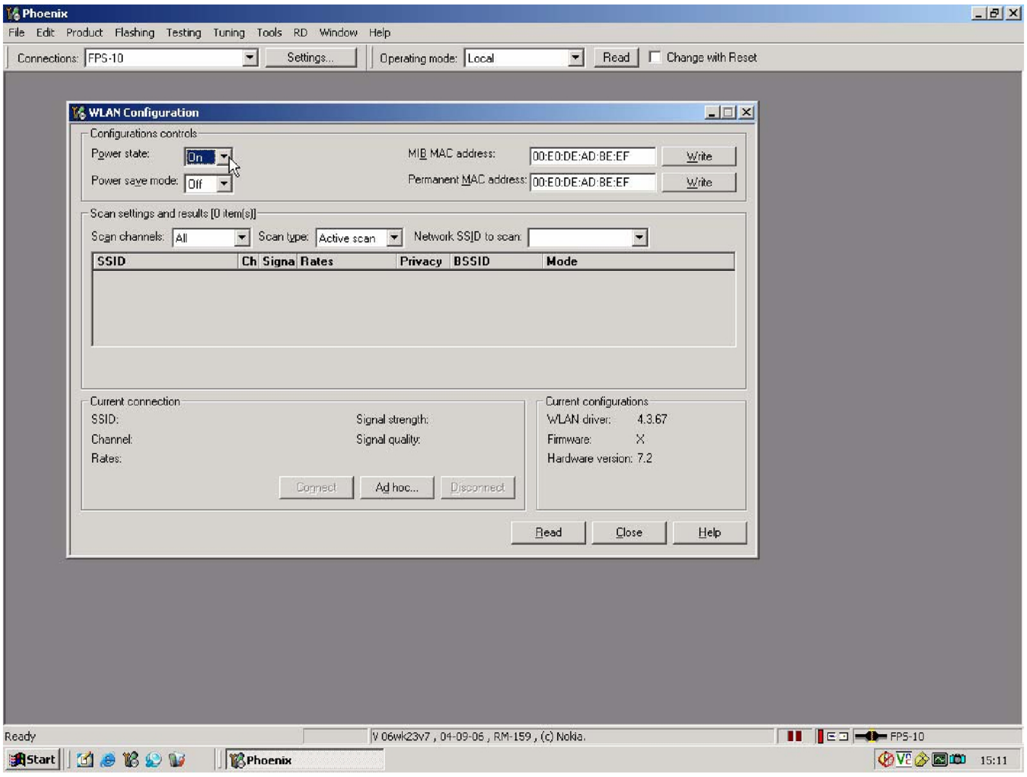
On/Off test

From the testing toolbar select **WLAN Configuration** option. This opens the WLAN configuration dialogue box below. Selecting the Power state option button (as indicated), the WLAN can be turned ON and OFF:

1 With Power State set to OFF, measure the dc power supply current consumption of the flash adaptor.

2 Next return the Power state to ON and re-measure the dc power supply current of the flash adaptor.

The difference between the currents in (1) and (2) should be between 60 and 90 mA When WLAN is ON, the firmware has been downloaded and the WLAN module is in the receive state. When OFF WLAN is powered down.


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
WLAN Configuration
Configurations controls
Write
Write
Scan settings and results [0 item(s)]
Current connection
Current configurations
Connect
Ad hoc...
Disconnect
Read
Close
Help
Start
Phoenix
15:11

Connections: FPS-10
Operating mode: Local
☐ Change with Reset

Power state: On
Power save mode: Off
MIB MAC address: 00:E0:DE:AD:BE:EF
Permanent MAC address: 00:E0:DE:AD:BE:EF

Scan channels: All
Scan type: Active scan
Network SSID to scan:

SSID	Ch	Signa	Rates	Privacy	BSSID	Mode

SSID:
Channel:
Rates:
Signal strength:
Signal quality:

WLAN driver: 4.3.67
Firmware: X
Hardware version: 7.2

Ready
V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.
FPS-10

TX tests

From the testing toolbar select WLAN Tx Test option shown below. This test can be used to verify TX configuration and functionality. The default settings are sufficient for testing the TX operation, although other channels and data rates are equally suitable. To start the test, select the Start option button:

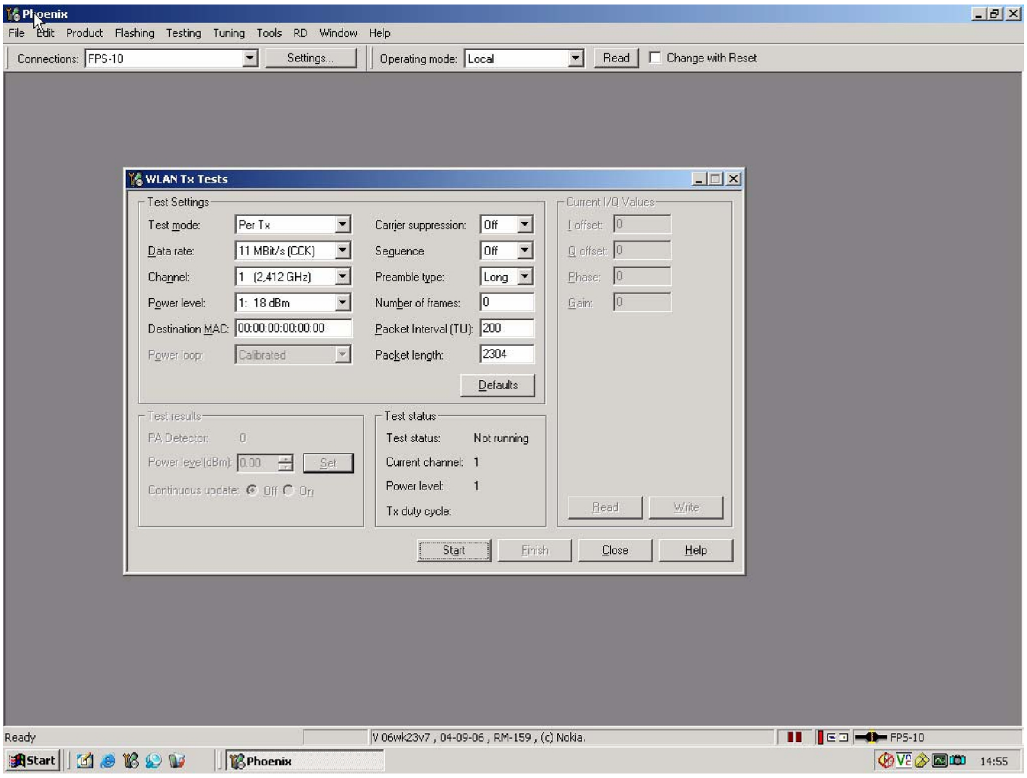
1 Measure and record the TX ON current consumption of the Phone/ flash adaptor.

2 Monitor the WLAN TX spectrum on a Spectrum analyser either using a co-ax cable connected to the WLAN TX antenna port or by making a radiated test with a suitable WLAN antenna connected to the spectrum analyser input. (When making a radiated test ensure that other WLAN devices are not transmitting as these may be detected as well, confusing the result).

3 To finish the test select the Finish option button

4 Measure the TX OFF current consumption of the phone/flash adaptor.

The difference between the two readings should be 50 - 75 mA and measures the transmit current in 11MBPS, 802.11b mode of operation.



Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
WLAN Tx Tests
Test Settings
Current I/Q Values
Defaults
Test results
Test status
Set
Read
Write
Start
Finish
Close
Help
Start
Phoenix
14:55

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

Test mode: Per Tx

Data rate: 11 MBit/s (CCK)

Channel: 1 (2,412 GHz)

Power level: 1: 18 dBm

Destination MAC: 00:00:00:00:00:00

Power loop: Calibrated

Carrier suppression: Off

Sequence: Off

Preamble type: Long

Number of frames: 0

Packet Interval (TU): 200

Packet length: 2304

I offset: 0

Q offset: 0

Phase: 0

Gain: 0

PA Detector: 0

Power level(dBm): 0.00

Continuous update: ● Off ○ On

Test status: Not running

Current channel: 1

Power level: 1

Tx duty cycle:

Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

FPS-10

RX Tests

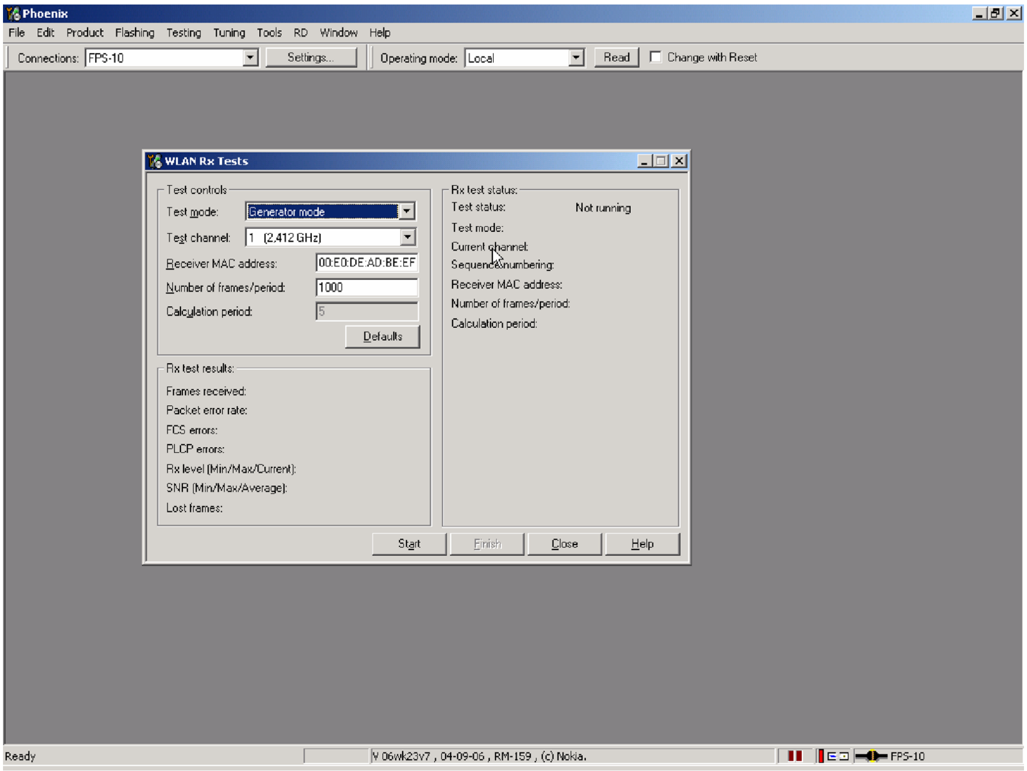
There are different options available for testing the Rx path. The simplest is to use the WLAN to report Rx packets when operating in an area where there is an active WLAN network. Simply starting an Rx test will show the number of packets detected by the WLAN module as it monitors the network. However, it does require a properly configured WLAN network. The alternative approach is to make a conducted test using a signal generator connected to the WLAN antenna port. The drawback in this approach is that the WLAN antenna connection in the phone is not actually tested.

From the testing toolbar select WLAN Rx Test option shown below. This test can be used to verify Rx configuration and functionality.

To start the test, select the Start option button.

As the WLAN monitors an active WLAN network, the Rx test results window will update and show the number of Frames received, as well as the Packer error rate. If there is no data reported in the "Rx test results" screen, please change the "test channel" number.

Monitoring the detected frames is a simple method to verify the WLAN antenna and receiver path is working properly. The current consumption of the phone/flash adaptor before and during the Rx test should be the same (10 mA max difference).


Phoenix
File Edit Product Flashing Testing Tuning Tools RD Window Help
Settings...
Read
WLAN Rx Tests
Defaults
Start
Finish
Close
Help

Connections: FPS-10

Operating mode: Local

☐ Change with Reset

Test controls

Test mode: Generator mode

Test channel: 1 (2,412 GHz)

Receiver MAC address: 00:E0:DE:AD:BE:EF

Number of frames/period: 1000

Calculation period: 5

Rx test results:

Frames received:
Packet error rate:
FCS errors:
PLCP errors:
Rx level (Min/Max/Current):
SNR (Min/Max/Average):
Lost frames:

Rx test status:

Test status: Not running

Test mode:
Current channel:
Sequence numbering:
Receiver MAC address:
Number of frames/period:
Calculation period:

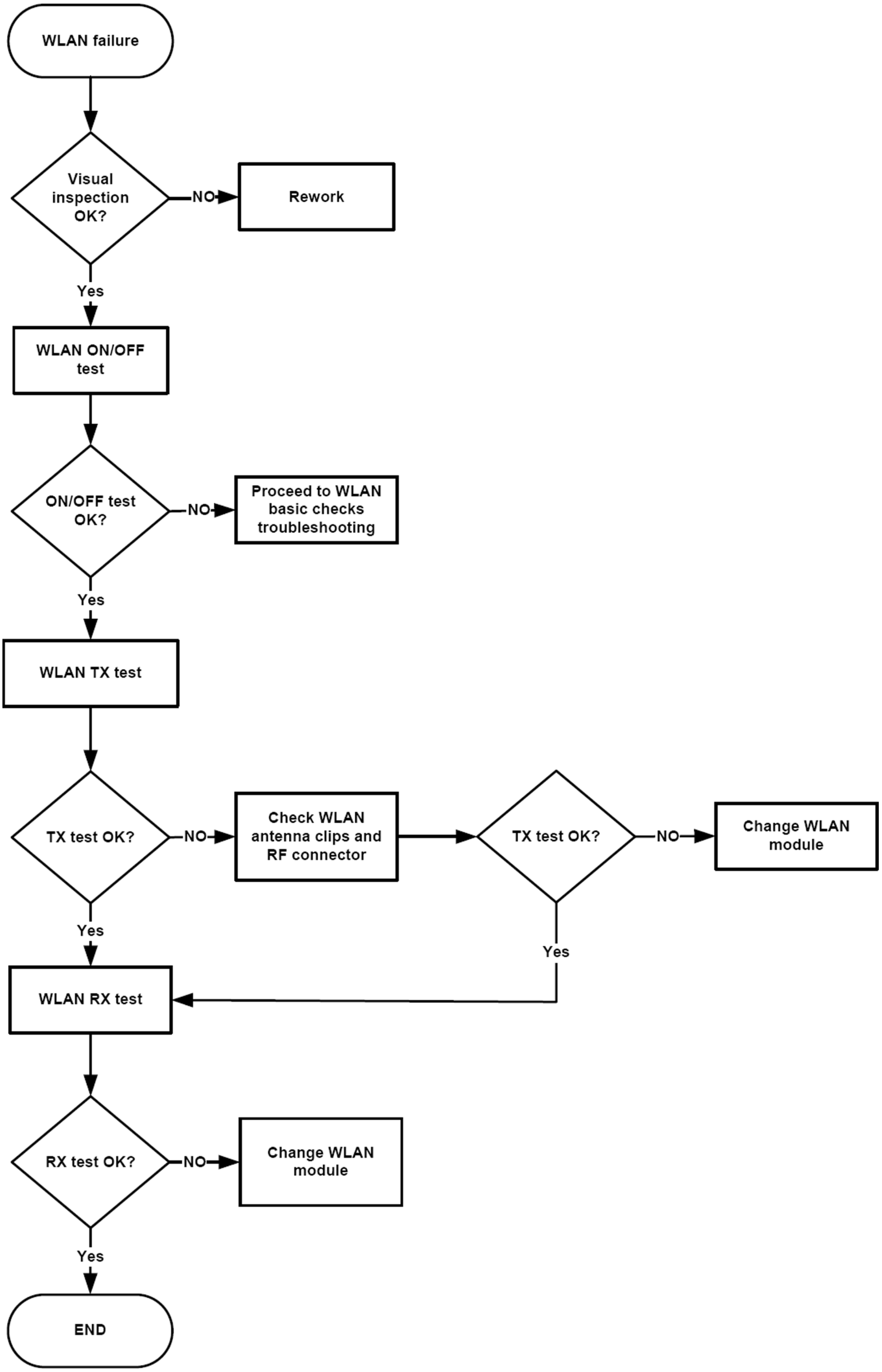
Ready

V 06wk23v7 , 04-09-06 , RM-159 , (c) Nokia.

FPS-10

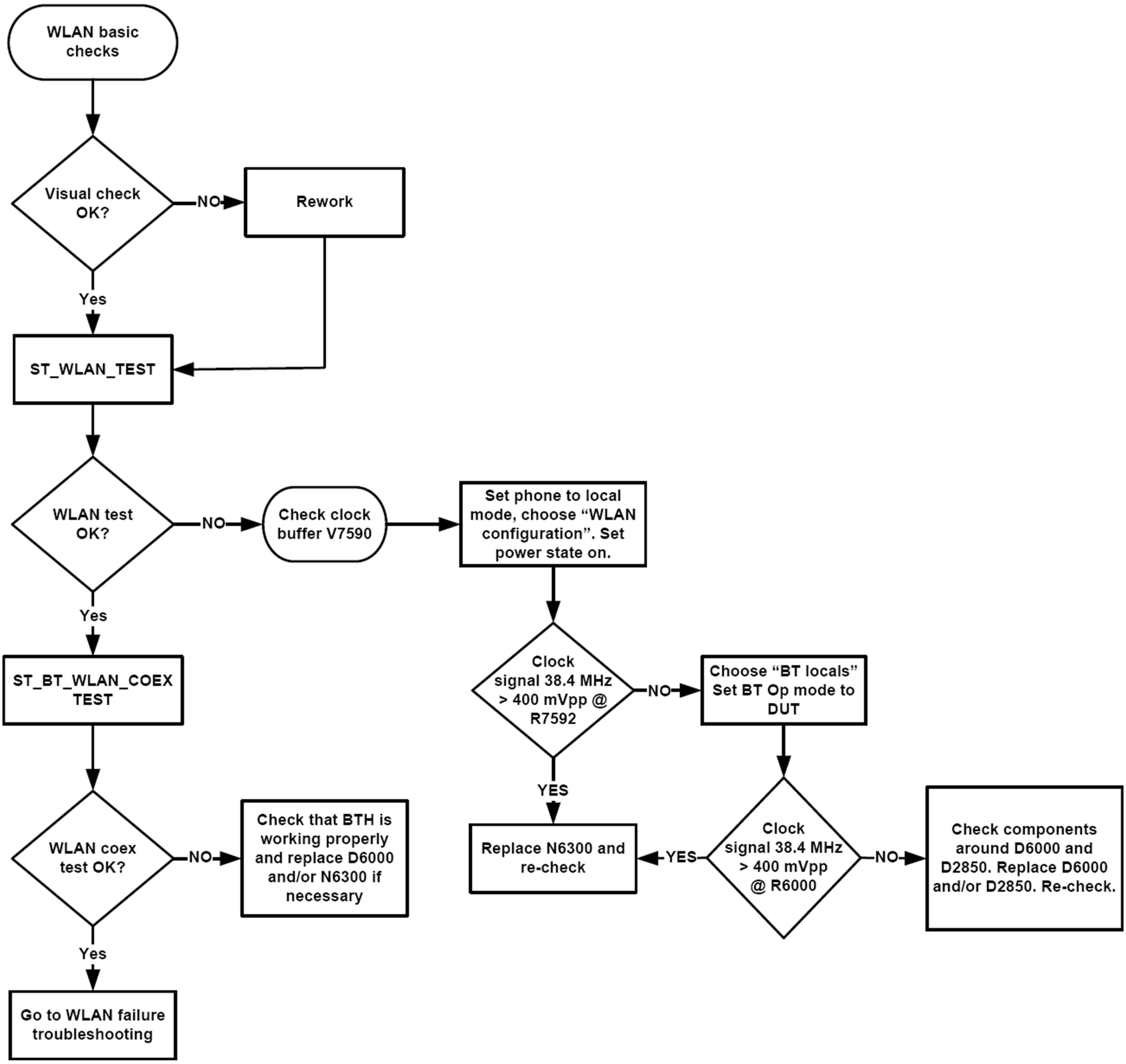
WLAN failure troubleshooting

Troubleshooting flow


WLAN failure
Visual inspection OK?
NO
Rework
Yes
WLAN ON/OFF test
ON/OFF test OK?
NO
Proceed to WLAN basic checks troubleshooting
Yes
WLAN TX test
TX test OK?
NO
Check WLAN antenna clips and RF connector
TX test OK?
NO
Change WLAN module
Yes
Yes
WLAN RX test
RX test OK?
NO
Change WLAN module
Yes
END

WLAN basic checks troubleshooting

Troubleshooting flow


WLAN basic checks
Visual check OK?
NO
Rework
Yes
ST_WLAN_TEST
WLAN test OK?
NO
Check clock buffer V7590
Set phone to local mode, choose “WLAN configuration”. Set power state on.
Clock signal 38.4 MHz > 400 mVpp @ R7592
NO
Choose “BT locals” Set BT Op mode to DUT
YES
Replace N6300 and re-check
YES
Clock signal 38.4 MHz > 400 mVpp @ R6000
NO
Check components around D6000 and D2850. Replace D6000 and/or D2850. Re-check.
Yes
ST_BT_WLAN_COEX TEST
WLAN coex test OK?
NO
Check that BTH is working properly and replace D6000 and/or N6300 if necessary
Yes
Go to WLAN failure troubleshooting

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5 — Camera Module Troubleshooting

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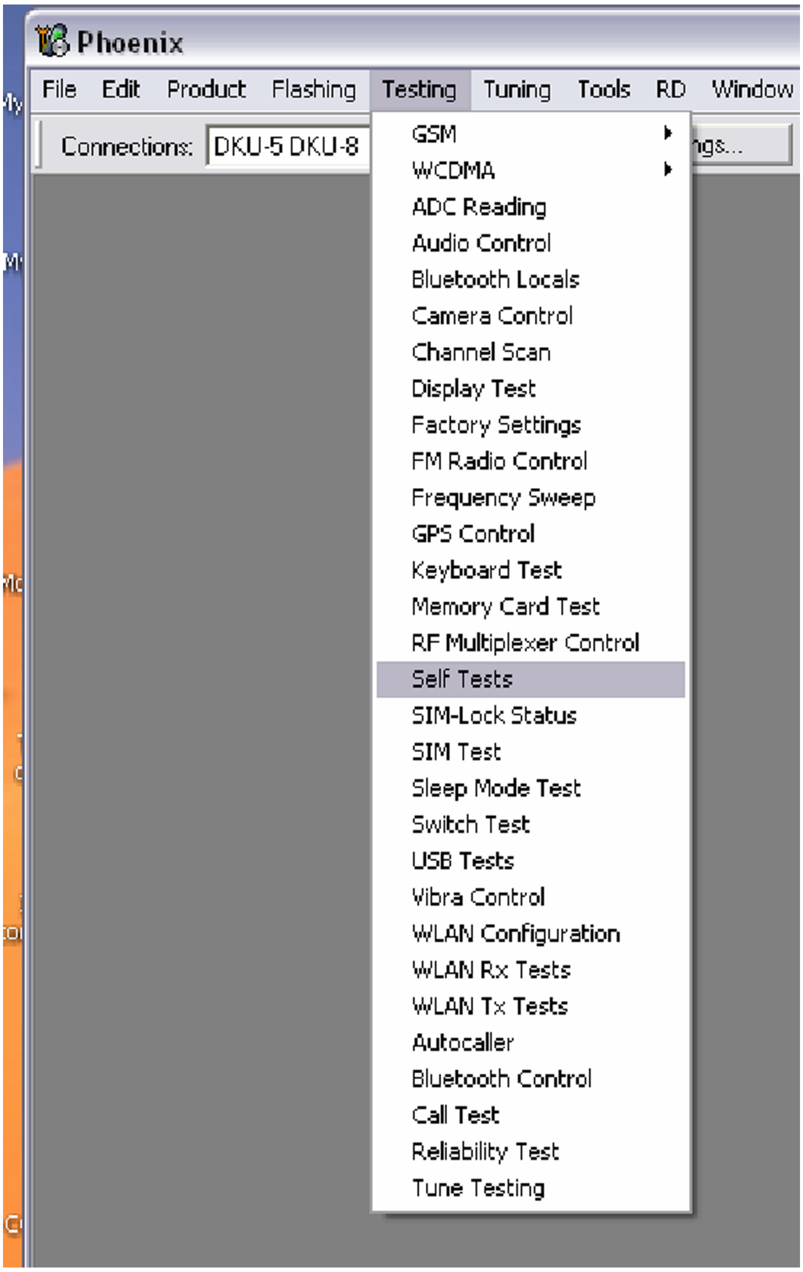
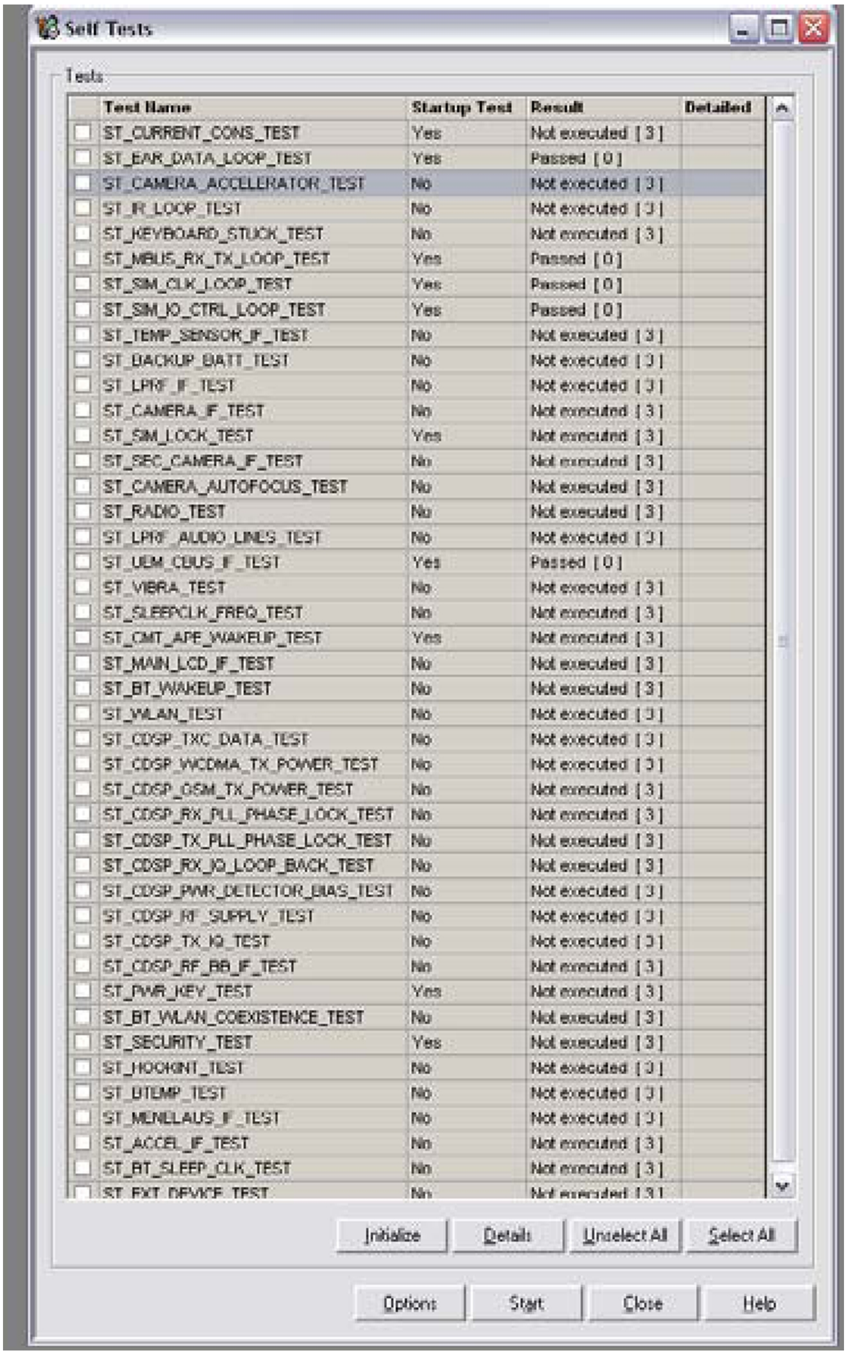
Camera tests for Phoenix

Steps

1. The self tests can be executed from Phoenix test software. Connect the device to Phoenix, and select **Self Tests** from the **Testing** menu.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
RD
Window
Connections:
DKU-5 DKU-8
ngs...
GSM
WCDMA
ADC Reading
Audio Control
Bluetooth Locals
Camera Control
Channel Scan
Display Test
Factory Settings
FM Radio Control
Frequency Sweep
GPS Control
Keyboard Test
Memory Card Test
RF Multiplexer Control
Self Tests
SIM-Lock Status
SIM Test
Sleep Mode Test
Switch Test
USB Tests
Vibra Control
WLAN Configuration
WLAN Rx Tests
WLAN Tx Tests
Autocaller
Bluetooth Control
Call Test
Reliability Test
Tune Testing

2. The following selection of tests will open (the visibility of the different tests depends on the device in question).



	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_CAMERA_ACCELERATOR_TEST	No	Not executed [3]	
☐	ST_IR_LOOP_TEST	No	Not executed [3]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_MBUS_RX_TX_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_TEMP_SENSOR_IF_TEST	No	Not executed [3]	
☐	ST_BACKUP_BATT_TEST	No	Not executed [3]	
☐	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☐	ST_SEC_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_AUTOFOCUS_TEST	No	Not executed [3]	
☐	ST_RADIO_TEST	No	Not executed [3]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_VIBRA_TEST	No	Not executed [3]	
☐	ST_SLEEPCLK_FREQ_TEST	No	Not executed [3]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_WLAN_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	
☐	ST_CDSP_WCDMA_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_GSM_TX_POWER_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Not executed [3]	
☐	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Not executed [3]	
☐	ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_SUPPLY_TEST	No	Not executed [3]	
☐	ST_CDSP_TX_IQ_TEST	No	Not executed [3]	
☐	ST_CDSP_RF_BB_IF_TEST	No	Not executed [3]	
☐	ST_PWR_KEY_TEST	Yes	Not executed [3]	
☐	ST_BT_WLAN_COEXISTENCE_TEST	No	Not executed [3]	
☐	ST_SECURITY_TEST	Yes	Not executed [3]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	
☐	ST_BTEMP_TEST	No	Not executed [3]	
☐	ST_MENELAUS_IF_TEST	No	Not executed [3]	
☐	ST_ACCEL_IF_TEST	No	Not executed [3]	
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]	
☐	ST_EXT_DEVICE_TEST	No	Not executed [3]	

Camera failure troubleshooting overview

Context

The camera troubleshooting is broken down into 2 parts: Automatic and manual check. The main purpose of the automatic check is to try and identify the fault automatically without any manual checks. If the automatic check does not provide enough information, manual check can be performed to narrow down the fault.

Troubleshooting flow

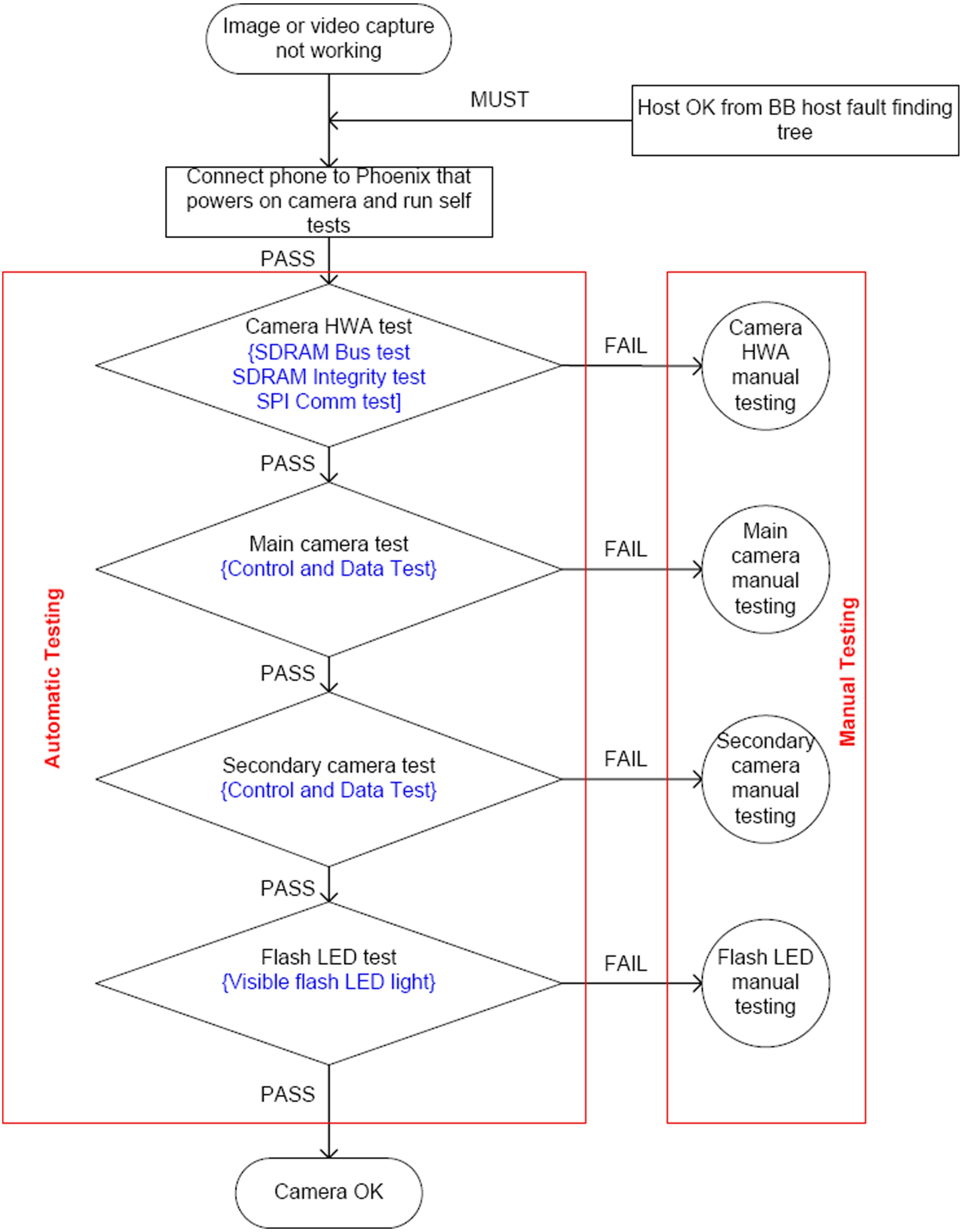
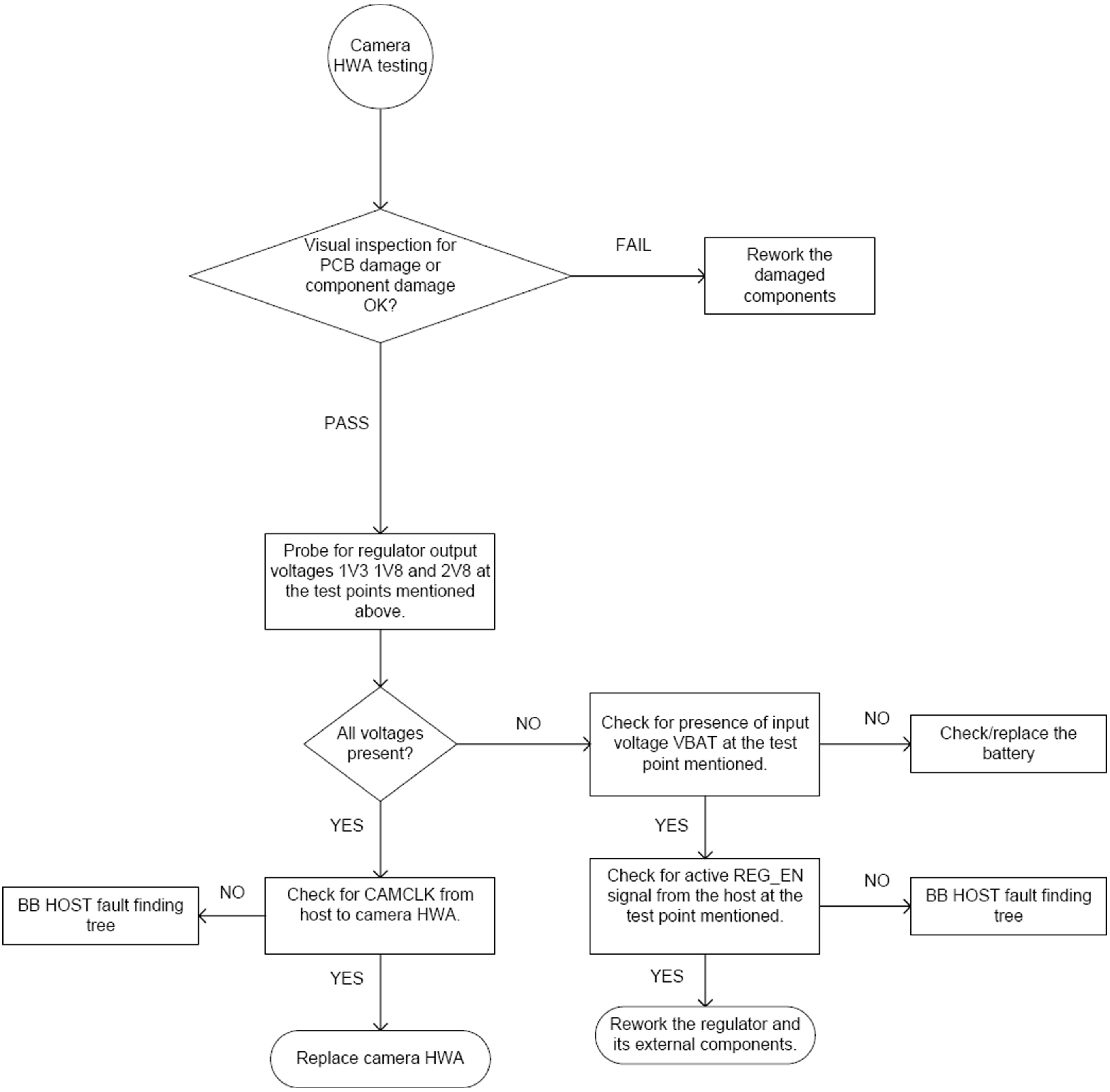


Image or video capture not working
MUST
Host OK from BB host fault finding tree
Connect phone to Phoenix that powers on camera and run self tests
PASS
Automatic Testing
Camera HWA test
{SDRAM Bus test
SDRAM Integrity test
SPI Comm test]
FAIL
Camera HWA manual testing
PASS
Main camera test
{Control and Data Test}
FAIL
Main camera manual testing
PASS
Secondary camera test
{Control and Data Test}
FAIL
Secondary camera manual testing
PASS
Flash LED test
{Visible flash LED light}
FAIL
Flash LED manual testing
Manual Testing
PASS
Camera OK

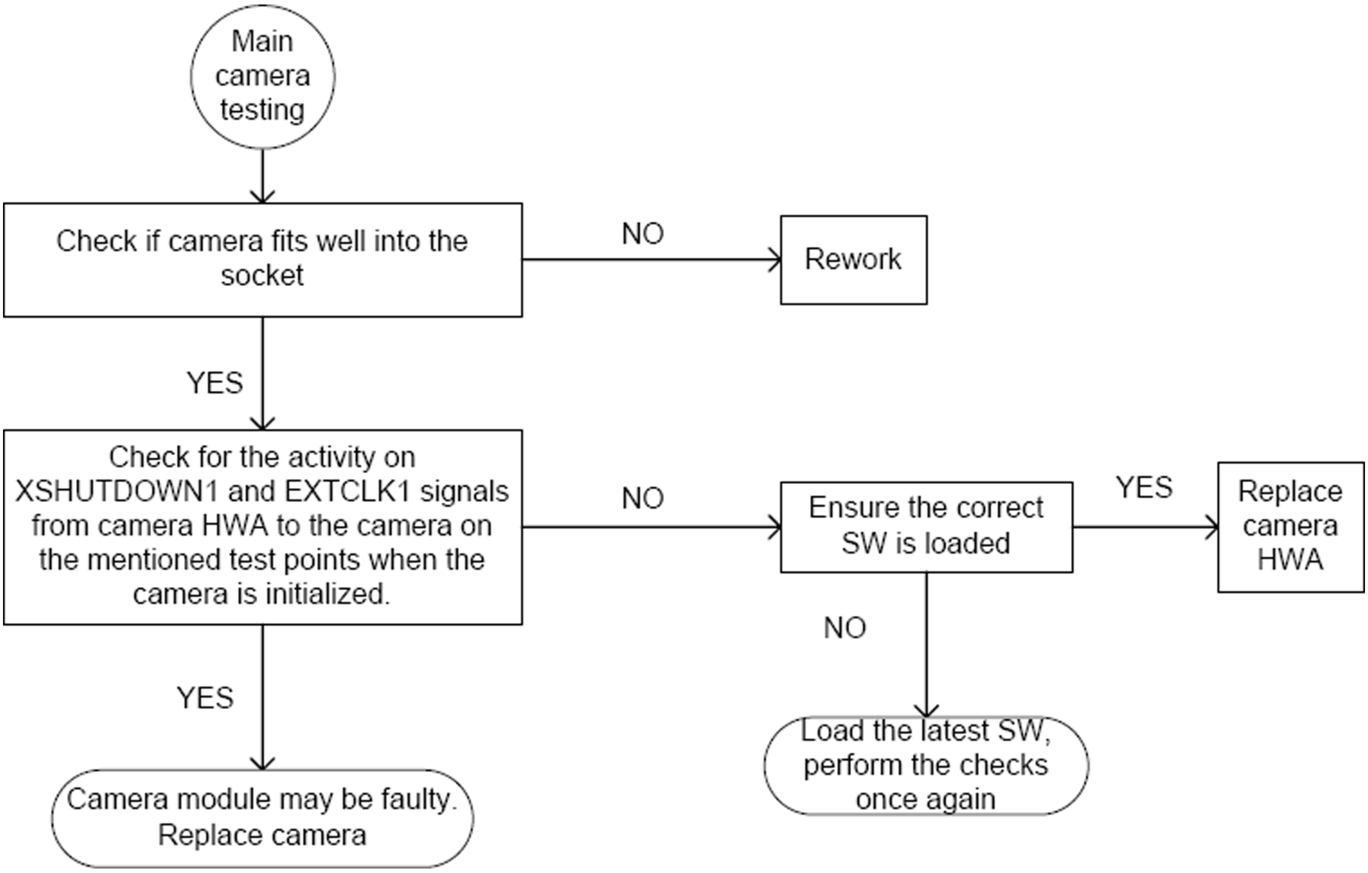
Camera HWA failure troubleshooting

Troubleshooting flow


Camera HWA testing
Visual inspection for PCB damage or component damage OK?
FAIL
Rework the damaged components
PASS
Probe for regulator output voltages 1V3 1V8 and 2V8 at the test points mentioned above.
All voltages present?
NO
Check for presence of input voltage VBAT at the test point mentioned.
NO
Check/replace the battery
YES
Check for active REG_EN signal from the host at the test point mentioned.
NO
BB HOST fault finding tree
YES
Rework the regulator and its external components.
YES
Check for CAMCLK from host to camera HWA.
NO
BB HOST fault finding tree
YES
Replace camera HWA

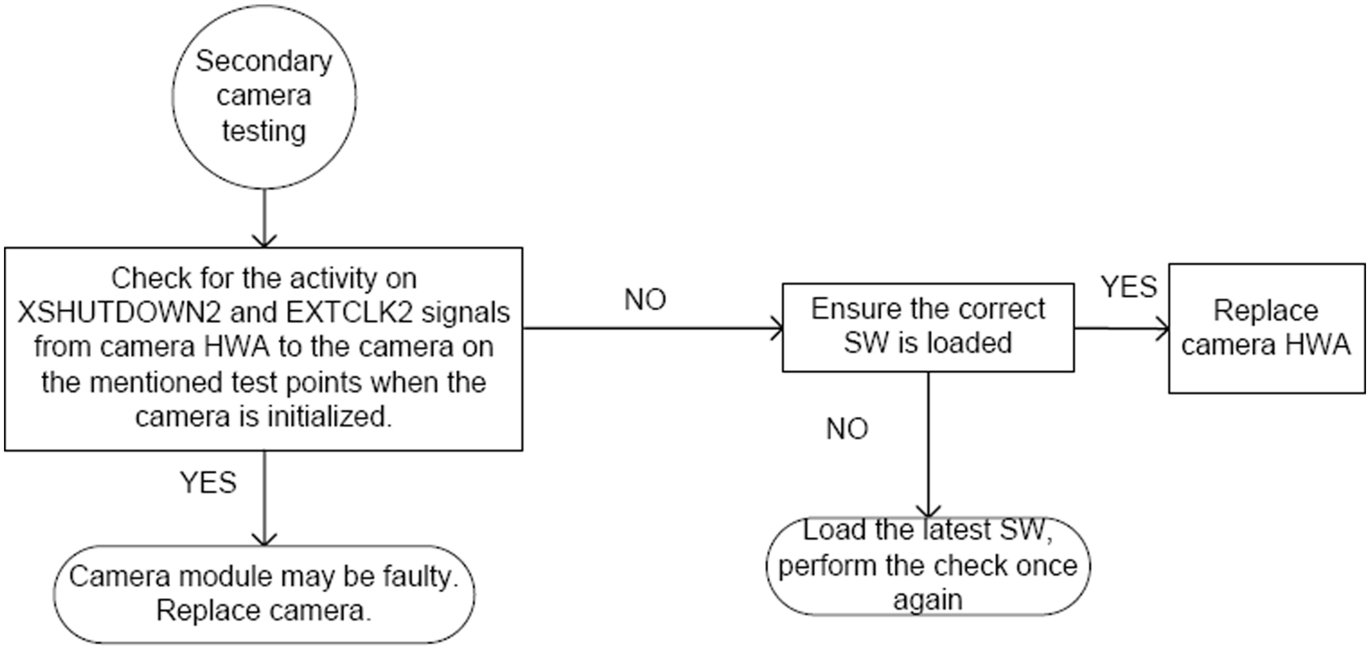
Main camera failure troubleshooting

Troubleshooting flow


Main camera testing
Check if camera fits well into the socket
NO
Rework
YES
Check for the activity on XSHUTDOWN1 and EXTCLK1 signals from camera HWA to the camera on the mentioned test points when the camera is initialized.
NO
Ensure the correct SW is loaded
YES
Replace camera HWA
NO
YES
Load the latest SW, perform the checks once again
Camera module may be faulty. Replace camera

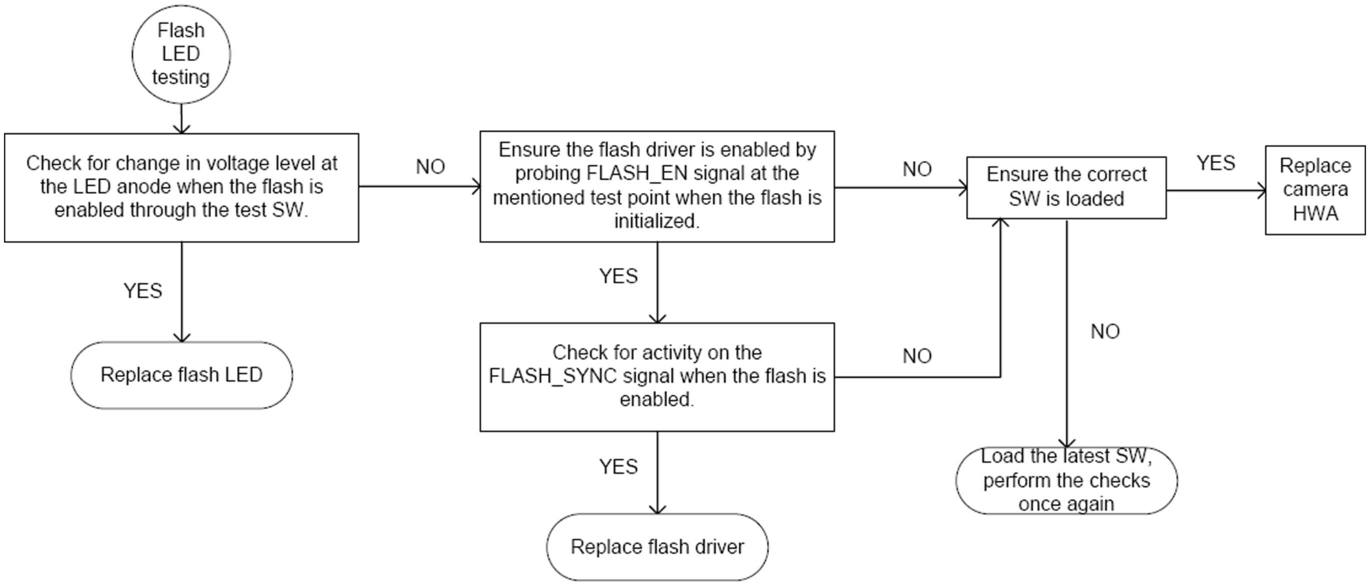
Secondary camera failure troubleshooting

Troubleshooting flow


Secondary camera testing
Check for the activity on XSHUTDOWN2 and EXTCLK2 signals from camera HWA to the camera on the mentioned test points when the camera is initialized.
NO
Ensure the correct SW is loaded
YES
Replace camera HWA
NO
Load the latest SW, perform the check once again
YES
Camera module may be faulty. Replace camera.

Flash LED troubleshooting

Troubleshooting flow


Flash LED testing
Check for change in voltage level at the LED anode when the flash is enabled through the test SW.
NO
Ensure the flash driver is enabled by probing FLASH_EN signal at the mentioned test point when the flash is initialized.
NO
Ensure the correct SW is loaded
YES
Replace camera HWA
YES
Replace flash LED
YES
Check for activity on the FLASH_SYNC signal when the flash is enabled.
NO
NO
Load the latest SW, perform the checks once again
YES
Replace flash driver

6 — System Module and User Interface

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Introduction

Phone description

RapidoYawe is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE.

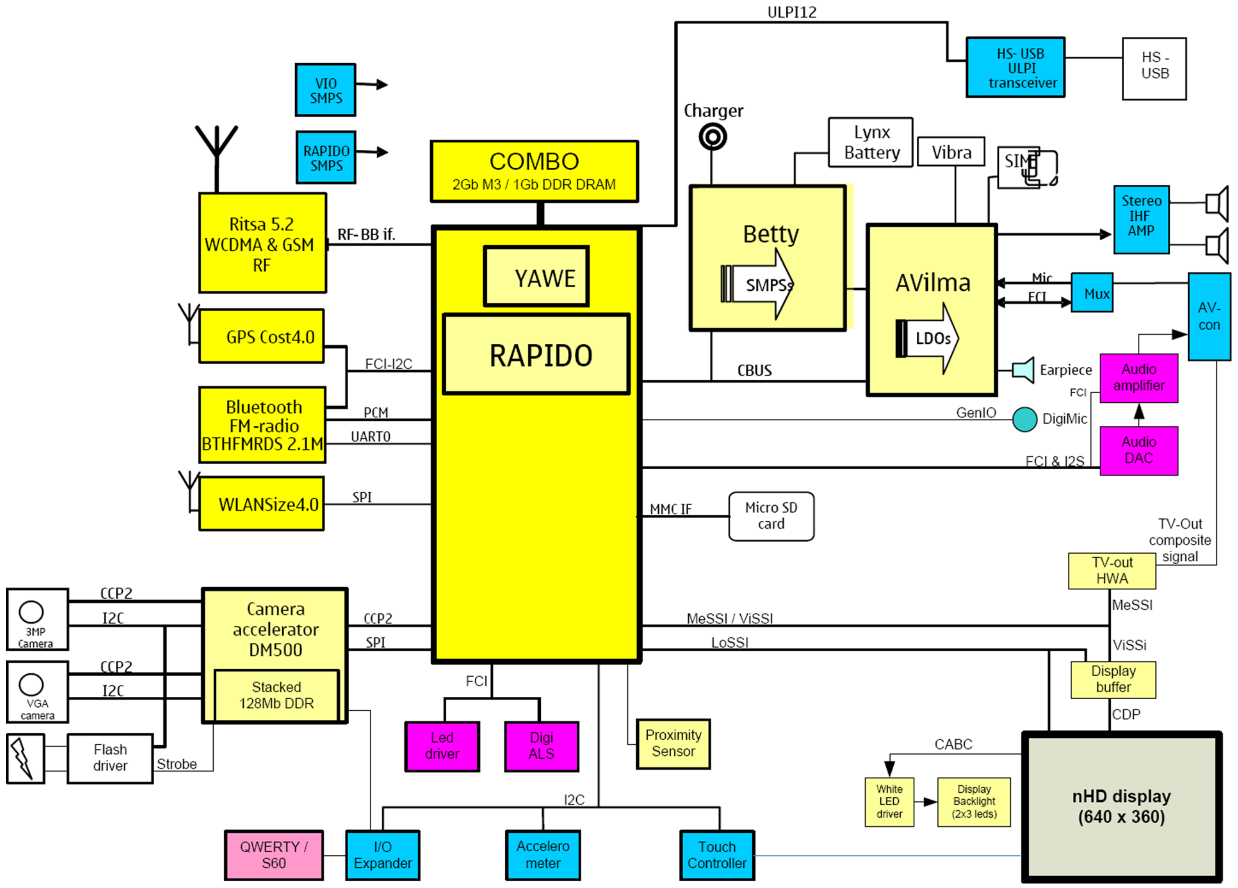
Avilma is mainly the audio ASIC in the phone and Betty is basically the energy management controller for the phone.

Bluetooth and FM radio are physically integrated in one single ASIC.

Key components

Function	Description	Item ref
Baseband ASIC	Avilma Betty	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RapidoYawe	D2800
Main camera accelerator	Julie DM-500	N1400
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA		N7540
Oscillators	VCTCXO 32.768 kHz crystall oscillator	G7501 B2200
Memory	1Gb DDR DRAM + 2Gb M3 NAND Flash Combo	D3000
Back-up battery	RTC back-up battery 311	G2200
FM radio	BTHFMRDS2.1M module	D6000
Bluetooth	BTHFMRDS2.1M module	D6000
Battery	BL-5J	
Battery connector	Tabby blade interface	X2070
RF connector		X7501
TV out	TV out graphics engine	D2480
Accelerometer		N6501
GPS	GPS ASIC GPS5350	N6200
WLAN	WLAN module	N6300
Touch screen controller (TSC2004)		N2450
Digital Ambient Light Sensor		N6502

System module block diagram


ULPI12
HS- USB ULPI transceiver
HS - USB
VIO SMPS
RAPIDO SMPS
Charger
Lynx Battery
Vibra
SIM
COMBO
2Gb M3 / 1Gb DDR DRAM
Ritsa 5.2 WCDMA & GSM RF
RF- BB if.
YAWE
RAPIDO
Betty
SMPSs
AVilma
LDOs
Stereo IHF AMP
Mic
FCI
Mux
AV-con
GPS Cost4.0
FCI-I2C
CBUS
Earpiece
FCI
Audio amplifier
Bluetooth FM-radio BTHFMRDS 2.1M
PCM
UART0
GenIO
DigiMic
Audio DAC
FCI & I2S
WLANSize4.0
SPI
MMC IF
Micro SD card
TV-Out composite signal
TV-out HWA
CCP2
I2C
3MP Camera
CCP2
I2C
VGA camera
Camera accelerator DM500
Stacked 128Mb DDR
CCP2
SPI
MeSSI / ViSSI
LoSSI
MeSSI
ViSSI
Display buffer
CDP
Flash driver
Strobe
FCI
Led driver
Digi ALS
Proximity Sensor
CABC
White LED driver
Display Backlight (2x3 leds)
nHD display (640 x 360)
I2C
QWERTY / S60
I/O Expander
Accelero meter
Touch Controller

Energy management

Battery and charging

BL-5J battery

The phone is powered by a 3-pole BL-5J S-pack 1320 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

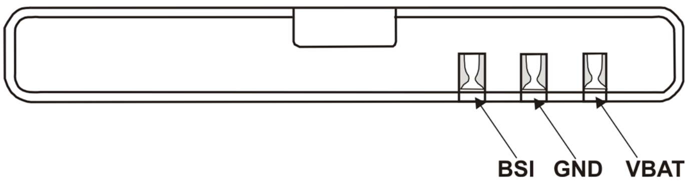

BSI
GND
VBAT

Figure 52 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)

- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

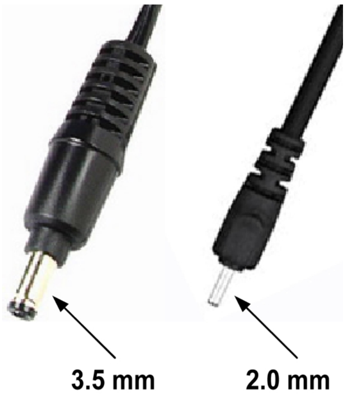


Figure 53 Small (right) and wide (left) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-5J S-pack battery is used.

Table 14 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage (fast charging)	4.230	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.15	In call

Voltage	Voltage [V]	Condition
Sw shutdown	3.3	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

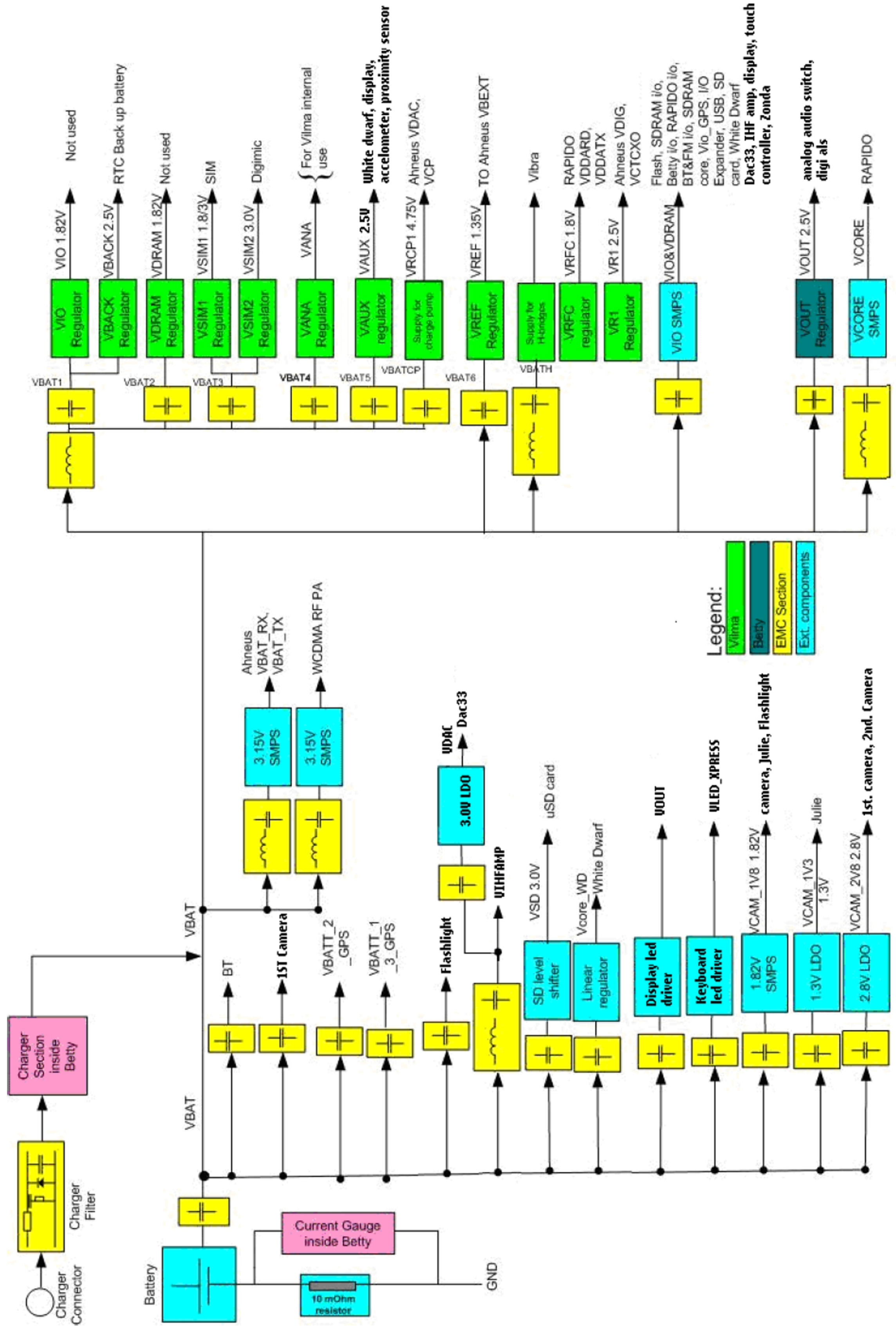
When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Power distribution


Charger Connector
Charger Filter
Charger Section inside Betty
VBAT
Battery
Current Gauge inside Betty
10 mOhm resistor
GND
VBAT
VBAT1
VBAT2
VBAT3
VBAT4
VBAT5
VBATCP
VBAT6
VBATH
VIO Regulator
VIO 1.82V
Not used
VBACK Regulator
VBACK 2.5V
RTC Back up battery
VDRAM Regulator
VDRAM 1.82V
Not used
VSIM1 Regulator
VSIM1 1.8/3V
SIM
VSIM2 Regulator
VSIM2 3.0V
Digimic
VANA Regulator
VANA
For Vilma internal use
VAUX regulator
VAUX 2.5V
White dwarf, display, accelometer, proximity sensor
Supply for charge pump
VRCP1 4.75V
Ahneus VDAC, VCP
VREF Regulator
VREF 1.35V
TO Ahneus VBEXT
Supply for H-bridges
Vibra
VRFC regulator
VRFC 1.8V
RAPIDO VDDARD, VDDATX
VR1 Regulator
VR1 2.5V
Ahneus VDIG, VCTCXO
VIO SMPS
VIO&VDRAM
Flash, SDRAM i/o, Betty i/o, RAPIDO i/o, BT&FM i/o, SDRAM core, Vio_GPS, I/O Expander, USB, SD card, White Dwarf
Dac33, IHF amp, display, touch controller, Zonda
VOUT Regulator
VOUT 2.5V
analog audio switch, digi als
VCORE SMPS
VCORE
RAPIDO
3.15V SMPS
Ahneus VBAT_RX, VBAT_TX
3.15V SMPS
WCDMA RF PA
Legend:
🟩 Vilma
🟦 Betty
🟨 EMC Section
🟦 Ext. components
BT
1ST Camera
VBATT_2_GPS
VBATT_1_3_GPS
Flashlight
3.0V LDO
VDAC
Dac33
VIHFAMP
SD level shifter
VSD 3.0V
uSD card
Linear regulator
Vcore_WD
White Dwarf
Display led driver
VOUT
Keyboard led driver
VLED_XPRESS
1.82V SMPS
VCAM_1V8 1.82V
camera, Julie, Flashlight
1.3V LDO
VCAM_1V3 1.3V
Julie
2.8V LDO
VCAM_2V8 2.8V
1st. camera, 2nd. Camera

Clocking scheme

In BB5, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by AVILMA with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAPIDO for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAPIDO to BETTY. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from AHNEUS ASIC to BT module.

CLK600. The clock source is internal RC oscillator in BETTY (during the power-up sequence) or RAPIDO SMPS Clk.

Figure 54 RM-356 clocking scheme, TBD

Bluetooth

Bluetooth module BTHFMRDS2.1M provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Bluetooth can also be used as a wireless link between a personal computer and the phone.

Bluetooth connects directly to the Rapido with UART (universal asynchronous reveiver / transmitter). Control signals are connected to Rapido’s genios (BT_Wakeup, UART_Wakeup, Reset.) Bluetooth digital audio is connected to Rapido via PCM interface.

Clock source for Bluetooth module is a separated 38.4MHz oscillator, which is also used for WLAN module. BT/WLAN clock request signals are combined together for a common clock request signal, which is then used as wake-up control of the oscillator IC. 38.4MHz clock is used as a sysclk for BT module.

BTHFMRDS2.1M is using VIO 1.8V as its only power source..

The Bluetooth is physically integrated with the FM radio into the same module.

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

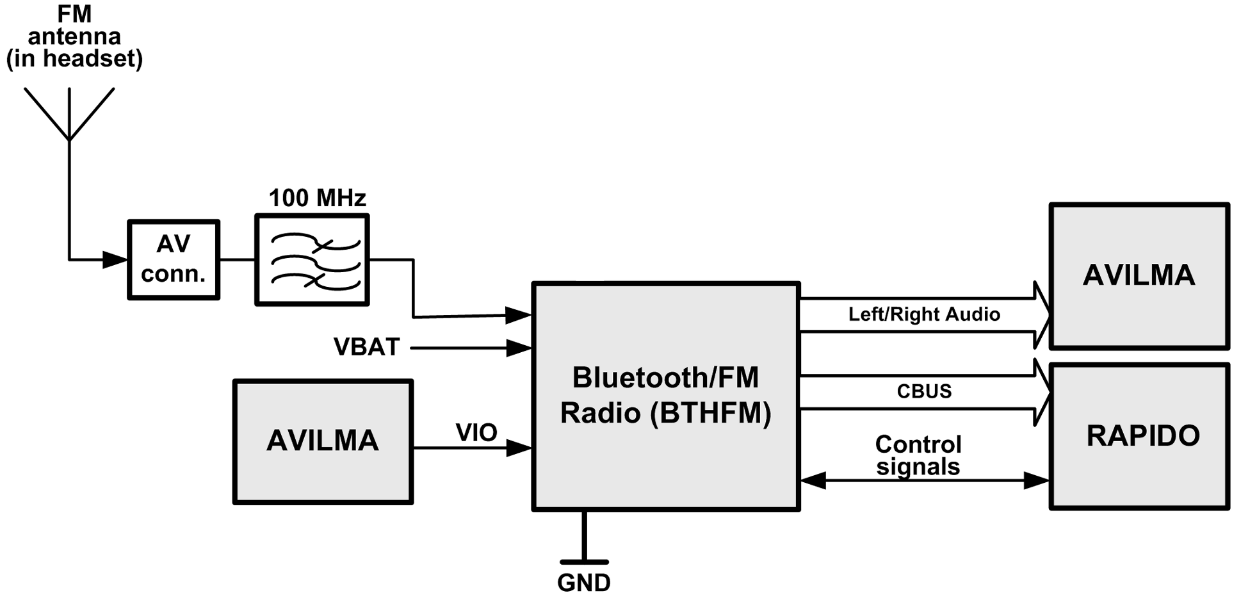


Figure 55 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as elements of the antenna, and no other antenna is needed for FM radio reception.

The radio has an automatic band search function, which can search for a strong station.

High-speed USB

The device can transmit and receive USB data at high-speed (480 Mbit/s), full-speed (12 Mbit/s) and low-speed (1.5Mbit/s).

The USB connection is implemented using D3300 ULPI high-speed USB transceiver and the ULPI interface from Cellular ASIC D2800. External interface is the micro B connector X3300.

The interface between D3300 USB transceiver and micro B receptacle is standard USB interface specified in Universal Serial Bus specification Rev. 2.0.

The USB transfers signal and power over four-wire interface, which carries differential data, Vbus and GND.

Signalling occurs over differential data line D+ and D-. The clock is transmitted encoded along with the differential data. ESD protection is done with USB ASIP Z3300. VBUS (+5V) is provided by the host device.

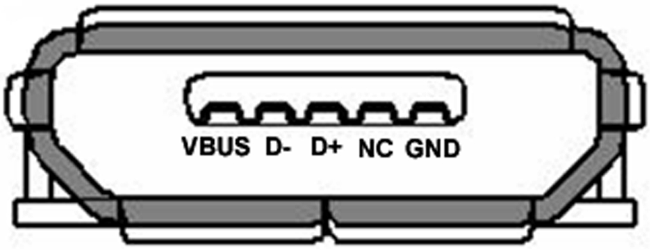


Figure 56 Micro B receptacle

CBUS interface

CBUS is a "main" system control bus in BB5. RAPIDO controls the functionality of EM ASICs AVilma (N2200) and Betty (N2300) with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In HW51 CBUS clock frequency is 4.39 MHz.

FBUS

USB and FBUS have multiplexed interface between EM ASIC (2300) and RAPIDO.

ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

Charger interface

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

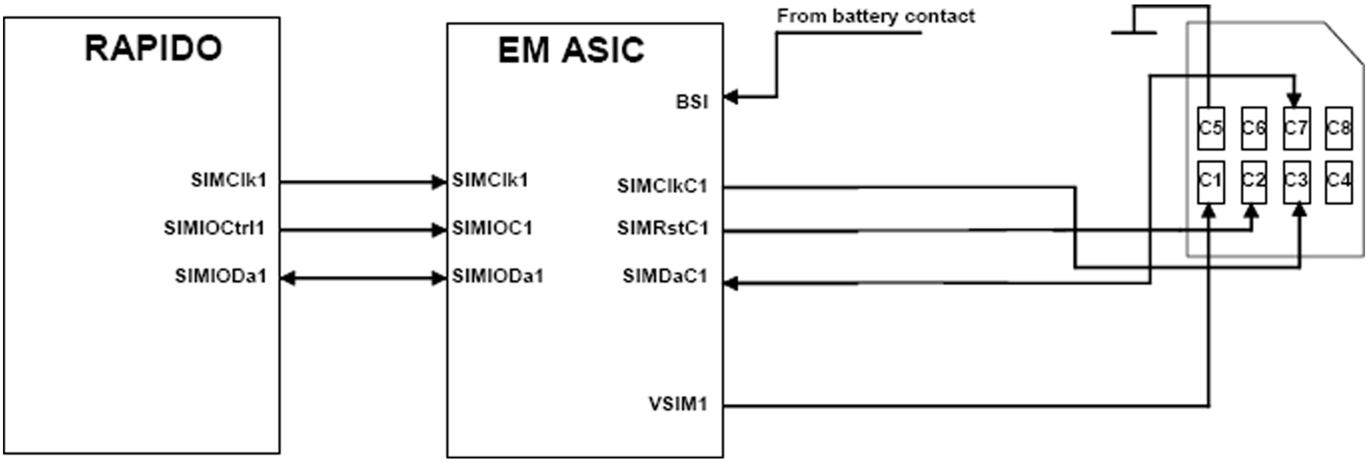
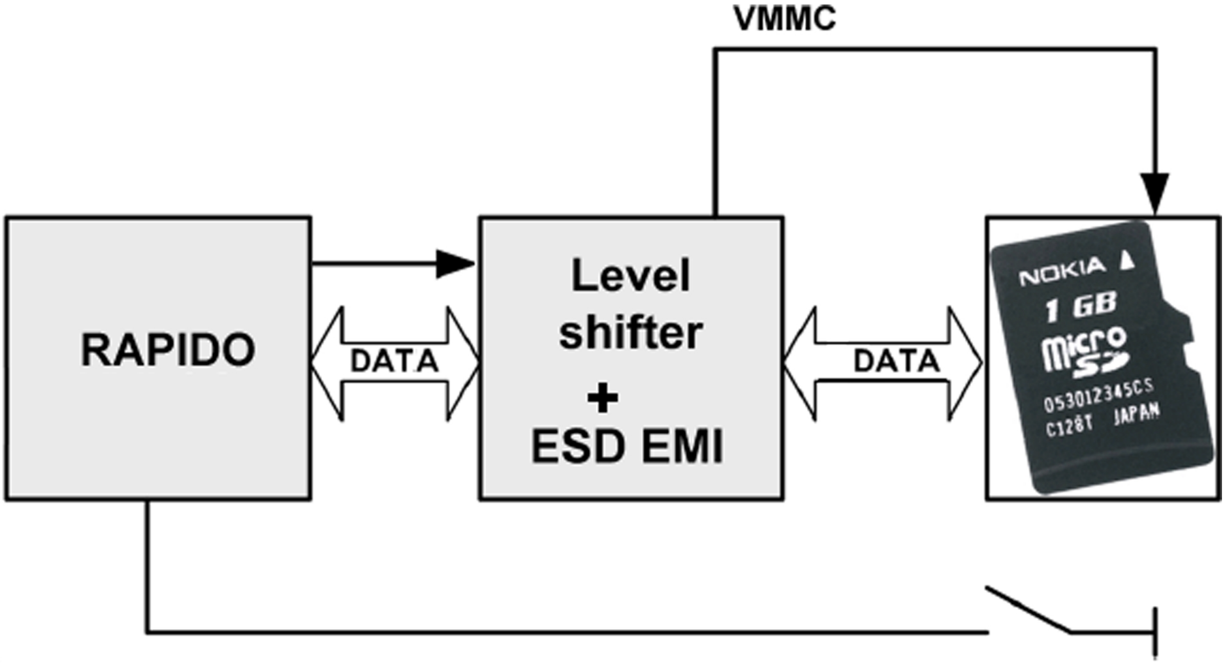

RAPIDO
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
C5
C6
C7
C8
C1
C2
C3
C4

Figure 57 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

µSD card interface


VMMC
RAPIDO
DATA
Level shifter
+
ESD EMI
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

The µSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The µSD card door state is detected by a detect switch. When the door is open, the µSD card is powered off. Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Accelerometer

The 3-dimensional accelerometer measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock.

The features using accelerometer in RM-356 are:

- Turn-to-mute (ringing tone & alarm)
- UI auto rotate
- Gaming control

The accelerometer (N6501) is connected to I2C. One GENIO is reserved for interrupt.

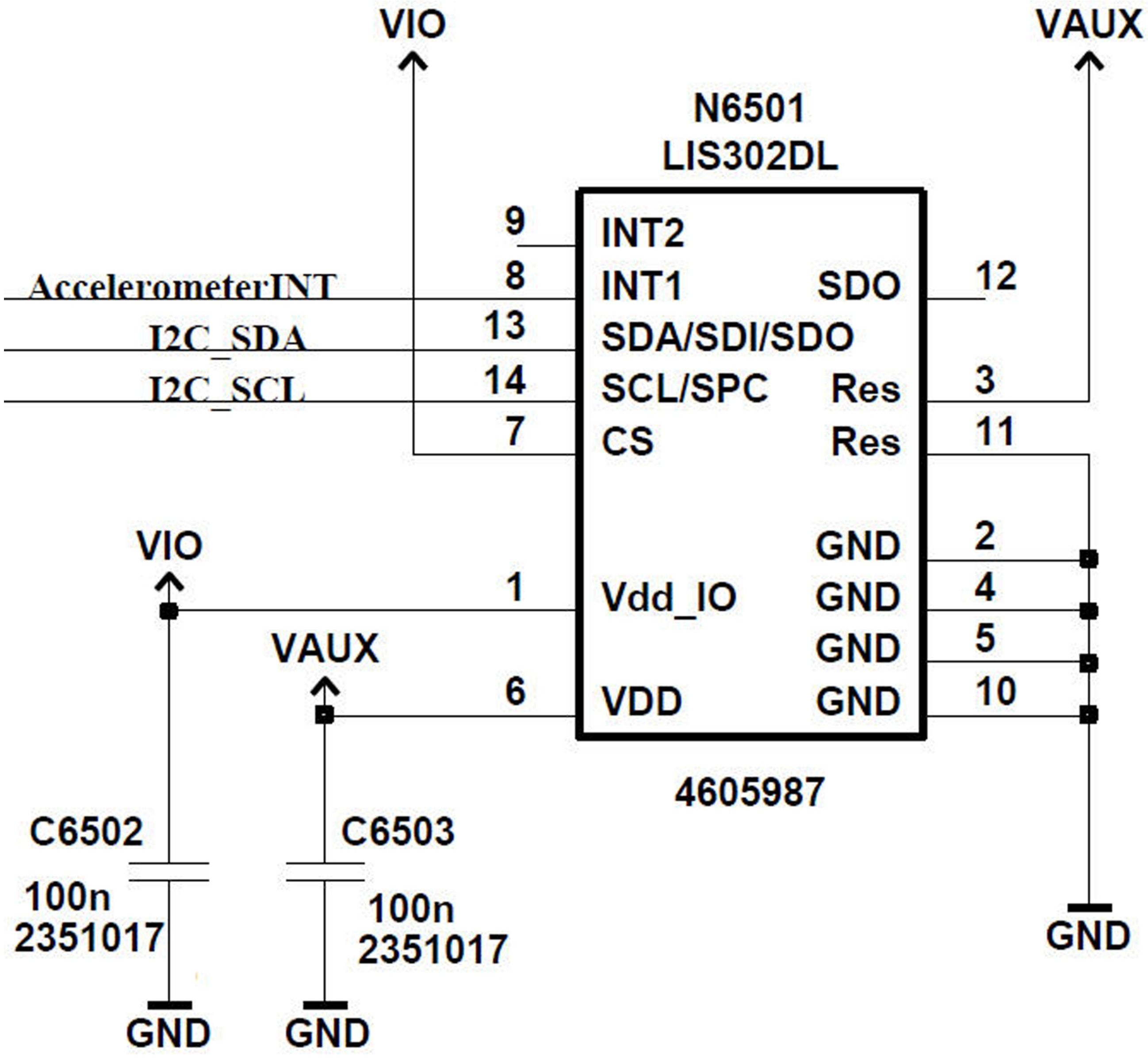

VIO
VAUX
N6501
LIS302DL
9
INT2
8
AccelerometerINT
INT1
SDO
12
13
I2C_SDA
SDA/SDI/SDO
14
I2C_SCL
SCL/SPC
Res
3
7
CS
Res
11
VIO
GND
2
1
Vdd_IO
GND
4
VAUX
GND
5
6
VDD
GND
10
4605987
C6502
100n
2351017
C6503
100n
2351017
GND
GND
GND

Figure 58 Accelerometer schematics

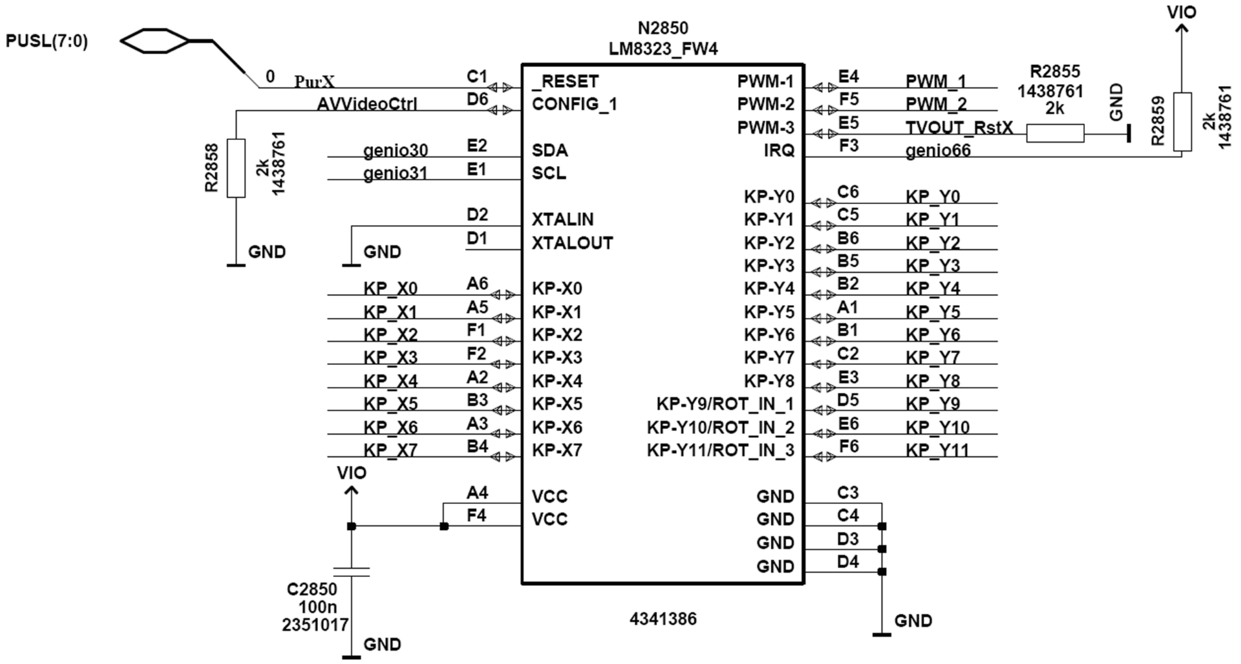
I/O Expander

I/O Expander is used for control signals that are not time critical, such as for keyboard inputs, enable & reset signals etc. It is connected to the I2C bus, and has its own interrupt. PURX is used as I/O Expander's reset. I/O Expander is powered from VIO 1.8V.

This device does not have a keyboard matrix, due to the minimal amount of keys needed in the touch input concept. Instead, keys are connected as SF keys. This means that the keys connect each row to the ground.

Two control signals are controlled by the I/O Expander, TV-out reset signal and AVVideoCtrl. AVVideoCtrl is used for two tasks: enabling TV out core regulator, and driving the switch that routes the TV out signal to the signature connector.

I/O EXPANDER


PUSL(7:0)
0
PurX
AVVideoCtrl
N2850
LM8323_FW4
C1
D6
_RESET
CONFIG_1
PWM-1
PWM-2
PWM-3
IRQ
E4
F5
E5
F3
PWM_1
PWM_2
TVOUT_RstX
genio66
R2855
1438761
2k
GND
VIO
R2859
2k
1438761
R2858
2k
1438761
GND
genio30
genio31
E2
E1
SDA
SCL
D2
D1
XTALIN
XTALOUT
GND
KP_X0
KP_X1
KP_X2
KP_X3
KP_X4
KP_X5
KP_X6
KP_X7
A6
A5
F1
F2
A2
B3
A3
B4
KP-X0
KP-X1
KP-X2
KP-X3
KP-X4
KP-X5
KP-X6
KP-X7
KP-Y0
KP-Y1
KP-Y2
KP-Y3
KP-Y4
KP-Y5
KP-Y6
KP-Y7
KP-Y8
KP-Y9/ROT_IN_1
KP-Y10/ROT_IN_2
KP-Y11/ROT_IN_3
C6
C5
B6
B5
B2
A1
B1
C2
E3
D5
E6
F6
KP_Y0
KP_Y1
KP_Y2
KP_Y3
KP_Y4
KP_Y5
KP_Y6
KP_Y7
KP_Y8
KP_Y9
KP_Y10
KP_Y11
VIO
A4
F4
VCC
VCC
GND
GND
GND
GND
C3
C4
D3
D4
C2850
100n
2351017
GND
4341386
GND

GPS interface

Functional description

The device includes an inbuilt GPS receiver and it works as a stand-alone positioning device.

The GPS solution provides a full GPS HW and SW engine for devices capable of operation in all GPS modes:

- Autonomous (standalone) - no communication with network is required for GPS fix
- MS based - the device receives aiding information from the network and computes fix internally
- MS assisted - the device receives aiding information from the network and computes pseudorange measurements. The measurements are then sent back to the network for the fix calculation.

At the heart of the GPS solution is GPS5350 GPS receiver IC, which has GPS RF receiver and GPS BB processor integrated into a single IC. RF section performs down conversion, filtering and IF sampling, whereas BB section contains an enhanced version of multimode GPS with twelve hardware matched filters, post detection logic and an ARM controller core.

The features of the GPS solution include:

- 12 channels
- Integrated regulators for RF and BB (including external LNA)
- Direct connection to a battery
- Fast clock calibration through availability of 261MHz clock from RF PLL
- Improved tracking and Hot start (TTFF) reacquisition performance
- Advanced Power Management and Host Wakeup capability.

The I2C interface handles data transfer between GPS and the Rapido. GPS uses the CE RF system clock to calibrate its own GPS Clk.

GPS has three clock sources:

- 16.368MHz clock from a dedicated TCXO (G6200)
- 38.4MHz reference clock from Ahneus RF ASIC
- 32.768kHz Sleepclk

The GPS module is powered from VIO 1.8V and VBAT.

Block diagram

The following block diagram shows how the GPS module is connected to the host side.

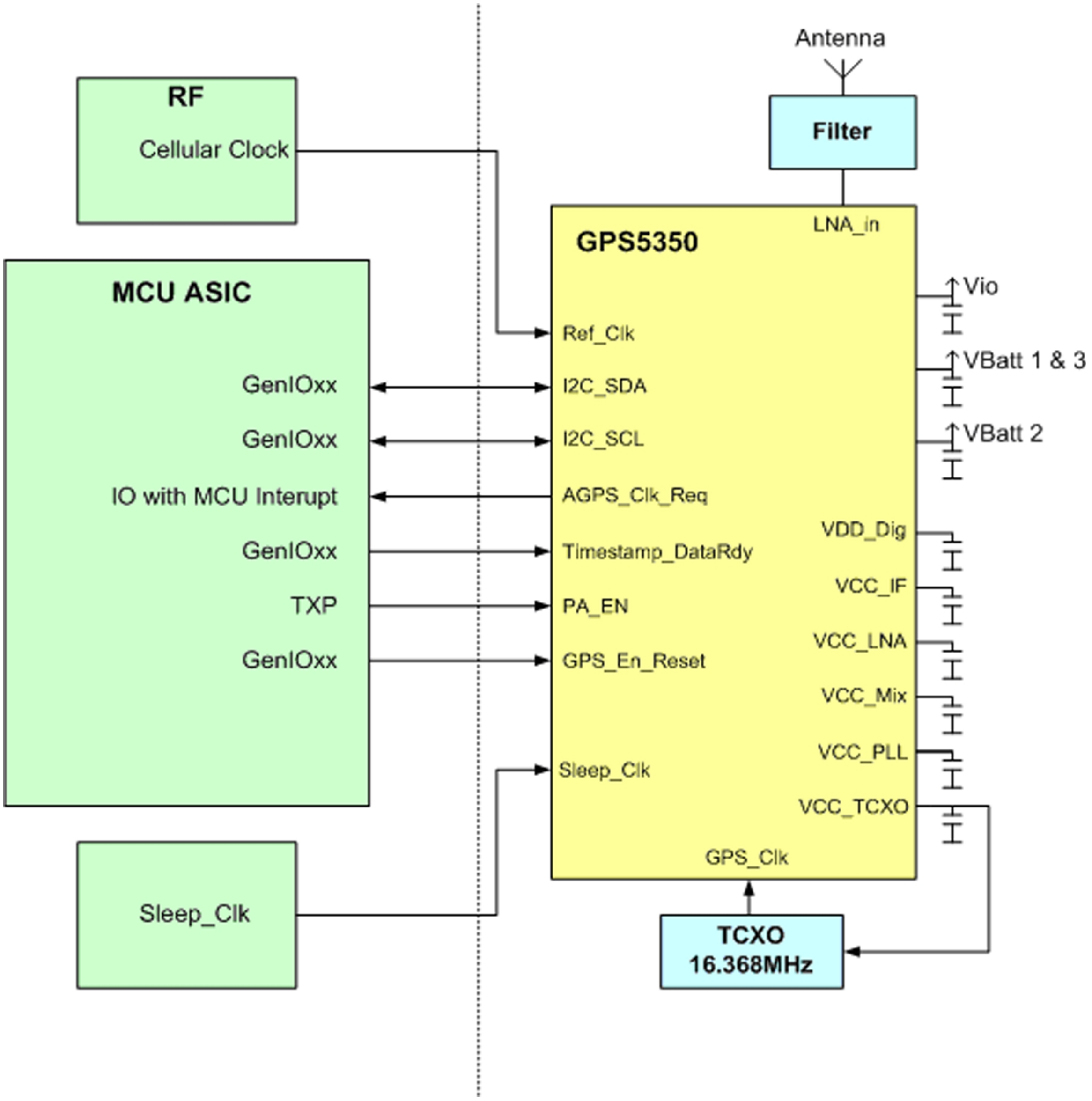

Antenna
RF
Cellular Clock
Filter
LNA_in
GPS5350
MCU ASIC
Vio
VBatt 1 & 3
VBatt 2
Ref_Clk
GenIOxx
I2C_SDA
GenIOxx
I2C_SCL
IO with MCU Interupt
AGPS_Clk_Req
VDD_Dig
GenIOxx
Timestamp_DataRdy
VCC_IF
TXP
PA_EN
VCC_LNA
GenIOxx
GPS_En_Reset
VCC_Mix
VCC_PLL
Sleep_Clk
VCC_TCXO
GPS_Clk
Sleep_Clk
TCXO
16.368MHz

Figure 59 Block diagram of the GPS system

Interface signals

Signal name	I/O	Function
RF		
ANT_GPS	I	GPS antenna port
LNA_In	I	GPS ASIC RF input
Clocking		
REF_CLK	I	Reference Clock = RF Cellular clock, Min 0.2V_{pk-pk}
GPS_CLK	I	Connection of 16.368MHz GPS TCXO
RTC_CLK	I	Cellular engine 32768 Hz sleep clock
Control		
GPS_EN_RESET	I	GPS engine reset
AGPS_CLK_REQ	O	MCU Interrupt when GPS requires CE to be awake (Host Wakeup)
IO_TIMESTAMP_DATARDY	I	Strobe for accurately marking in real time, timing information from the cellular engine. DATARDY indication to download code through synchronous operation from cellular engine.
IO_PA_EN	I	Used to implement PA blanking when cellular PA is ON
Comms		
I2C_SCL_U1TX	B	I2C clk line
I2C_SDA_U1RX	B	I2C data line
Power		
VDDS	P	Cellular engine I/O supply
VBatt 1 & 3	P	Phone battery power or SMPS power
VBatt 2	P	Phone battery power
VSS	P	Ground plane

WLAN functional description

Functional description

The WLAN Size 4.0 module is a single component Wireless Local Area Network (WLAN) radio access technology supporting the IEEE 802.11 standards, for low error rate data transfer between mobiles and WLAN networks. It incorporates a highly optimised WLAN chipset for mobile applications where low cost, small physical size and low power consumption are important attributes.

The Size 4.0 module houses a medium access controller (MAC) spread spectrum baseband processor with direct conversion radio interface, a 2.4GHz RF Front End chip and Power Management (PM) IC. Data rates up to 54Mbps are possible in 802.11g mode of operation.

The Front end chip provides low noise power amplification, power detection and RF switching functions. It also provides an extra RF port, so that Bluetooth can operate and share the antenna with WLAN.

The baseband processor includes the direct conversion radio stage and MAC. The radio is responsible for the modulation and demodulation of data and scrambling/encoding of data according to information supplied by the MAC. The power management IC provides power to the baseband processor and FE. It incorporates an SMPS and linear regulators allowing the WLAN to operate directly from the cellular phone battery.

The WLAN SW is downloaded from the host engine when the WLAN is turned on, over the dedicated SPI interface.

The 38.4 MHz reference clock from the host engine is shared with other radio technologies (e.g. Bluetooth) and WLAN uses the clock request signal to request the reference clock to be turned on when WLAN needs to use it.

Block diagram and interface signals

The following block diagram shows how the Wlan Size is connected to the Host side:

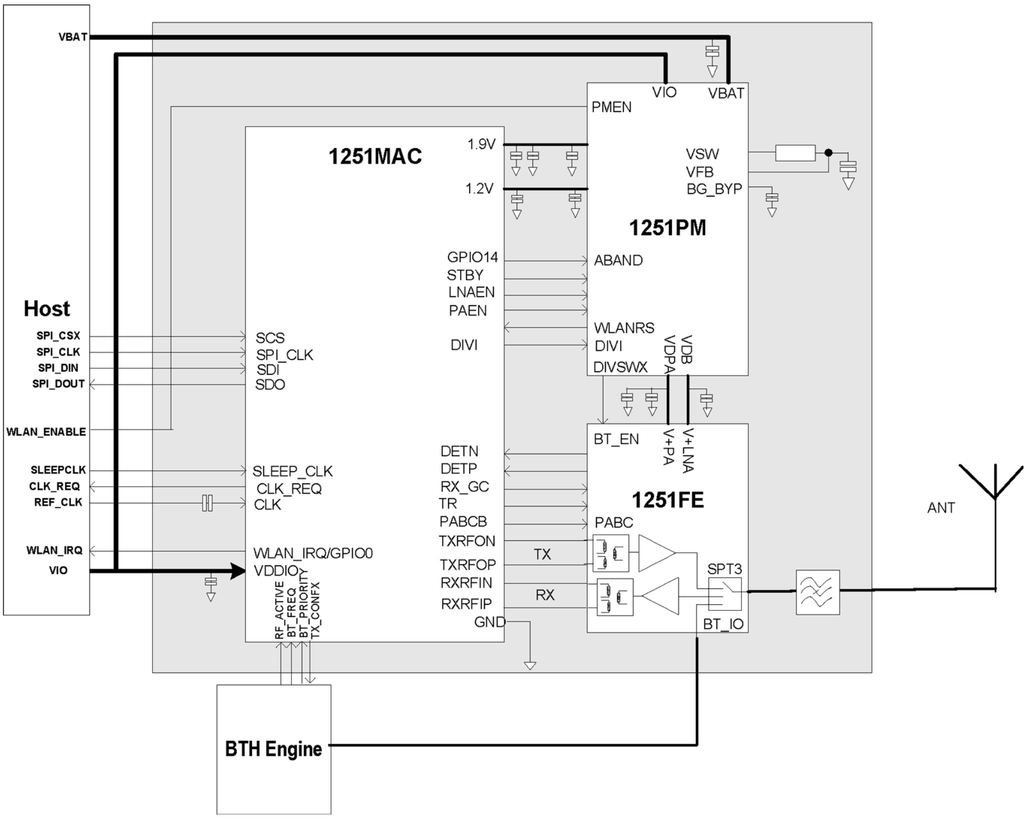

VBAT
Host
SPI_CSX
SPI_CLK
SPI_DIN
SPI_DOUT
WLAN_ENABLE
SLEEPCLK
CLK_REQ
REF_CLK
WLAN_IRQ
VIO
1251MAC
1.9V
1.2V
GPIO14
STBY
LNAEN
PAEN
DIVI
SCS
SPI_CLK
SDI
SDO
SLEEP_CLK
CLK_REQ
CLK
WLAN_IRQ/GPIO0
VDDIO
RF_ACTIVE
BT_FREQ
BT_PRIORITY
TX_CONFX
DETN
DETP
RX_GC
TR
PABCB
TXRFON
TXRFOP
RXRFIN
RXRFIP
GND
TX
RX
PMEN
VIO
VBAT
VSW
VFB
BG_BYP
1251PM
ABAND
WLANRS
DIVI
DIVSWX
VDB
VDPA
BT_EN
V+PA
V+LNA
1251FE
PABC
SPT3
BT_IO
ANT
BTH Engine

Figure 60 Block diagram

Table 15 Interface signals

SiModule pin	In/Out	Function
COMMS		
SPI_SDI	IN	SPI data from Host to WLAN module.
		Master out Slave in, MOSI. Sampled on the rising edge of the SPI Clock.

SiModule pin	In/Out	Function
SPI_SDO	OUT	SPI data from WLAN module to Host.
		Master in Slave out, MISO. Clocked out on the rising or falling edge of the clock (sw configurable in the initial command).
SPI_CLK	IN	SPI clock supplied from Host.
		Idle state of the clock is Low.
SPI_CSx	IN	SPI Chip select from Host. Active low
WLAN-BT COMMS		
BT_RF_ACTIVE	IN	Indicates BT activity to the WLAN PTA (Packet Traffic Arbitration).
		Asserted high for a BT transaction and remains active for the duration of the transaction.
BT_PRIORITY	IN	Indicates Status of BT activity to WLAN PTA.
BT_FREQ	IN	BT priority indication signal.
		Not used for Size 4.0 implementation.
BT_TX_CONFx	OUT	WLAN PTA decision signal to BT.
CONTROL		
PMEN	IN	WLAN Enable signal from Host.
WLAN_IRQ	OUT	Host wake-up request from WLAN Module. Active High
CLK_REQ	OUT	Clock request from WLAN module. Active High.
CLOCKING		
SLEEP_CLK	IN	Cellular engine 32.768KHz Sleep Clock
		Input capacitance is 7Pf max.
CLK	IN	System clock for WLAN Module. Typically 38.4MHz from external Tcxo.
RF		
ANT	OUT	Antenna input from product specific physical ISM antenna.
BT_RF	IN	RF feed to Bluetooth
POWER		
VIO	Power	Cellular engine IO supply
VBAT	Power	Battery supply from Phone.
VSS	Power	Ground Plane

TV out interface

The TV-out interface is implemented using the D2480 TV-out graphics engine that provides a direct support for TVout. The input data interface for D2480 is a 8-bit MeSSI (Medium Speed Screen Interface) parallel command/data display interface from D2800.

The global supply voltages are VIO from N2300 and VAUX from N2200. VCORE and VPLL supply voltages are regulated with N2498 using VIO and supply voltage from battery VBAT. The D2480 reset and regulator AV video control signals are taken from N2850.

For TV out the D2480 supports composite video output (CVBS) and NTSC or PAL output standards. CVBS is single video signal containing all of the necessary information to reproduce a color picture. The video signal is connected to an external AV connector pin 3. Switch N2122 is used to connect AV connector pin 3 into TV out and the same pin is used also as a microphone line.

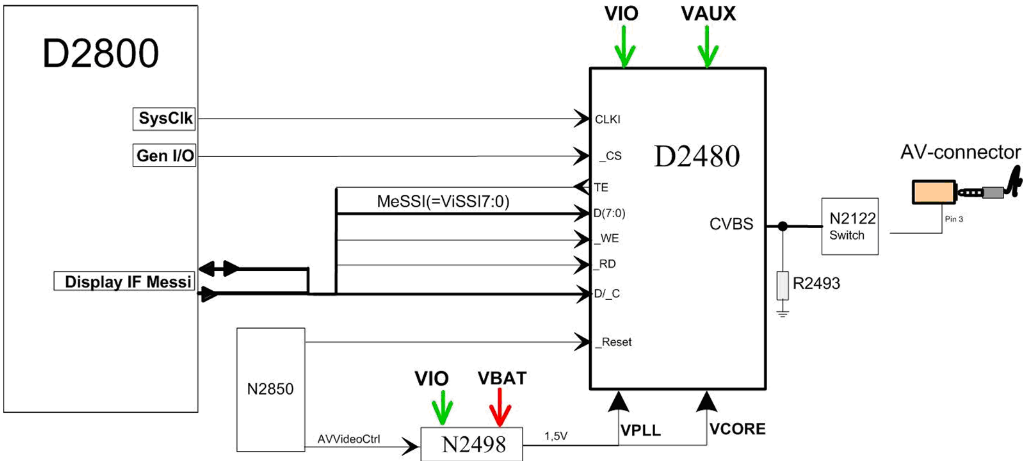


Figure 61 Block diagram of TV out connection

Camera concept

Imaging characteristics

The imaging and video baseband subsystem contains the complete imaging system for the cameras. The main features of the imaging and video baseband subsystem are:

- Hardware acceleration for image processing
- Support for the 3 megaixel main camera
- Support for secondary VGA camera module
- Support for Flash LEDs and its driver from ADI

Key components

DM500 imaging accelerator (N1400)

The imaging video baseband is implemented using the DM500 processor. The DM500 processor is a hardware accelerator for imaging and video applications. This processor controls all the cameras and flashes in the system.

This processor is controlled by Rapido via SPI interface. The boot code is downloaded into DM500 internal memory via the SPI interface at power on. Further application code (self test, image capture, video capture) is transferred depending on the usage case.

Video and still image data is passed to the Rapido for display & storage after processing over a CCP bus (CCP_CMT).

3 megapixel main camera

The camera module is SMIA85 compliant and is configured by the DM500 using I2C control bus. Image data is transferred to the DM500 over a CCP balanced bus (HIRES_CCP).

Secondary VGA camera

The camera module is SMIA compliant module and is configured by the DM500 using I2C control bus. Image data is transferred to the DM500 over a CCP balanced bus (LORES_CCP).

Flash LED

Camera flash LED is controlled from the DM500 via the ADP1653 driver. The driver has GPIO control for STROBE/ENABLE and I2C bus control for configuring.

Powering

The camera subsystem is powered from 1.3V, 1.8V and 2.8V and is generated internally in the subsystem from the VBAT. The LED driver is powered directly from the VBAT supply. These supplies are turned off/on by the host processor using the GPIO (Julie_REG_EN), depending in the camera usage.

Block diagram

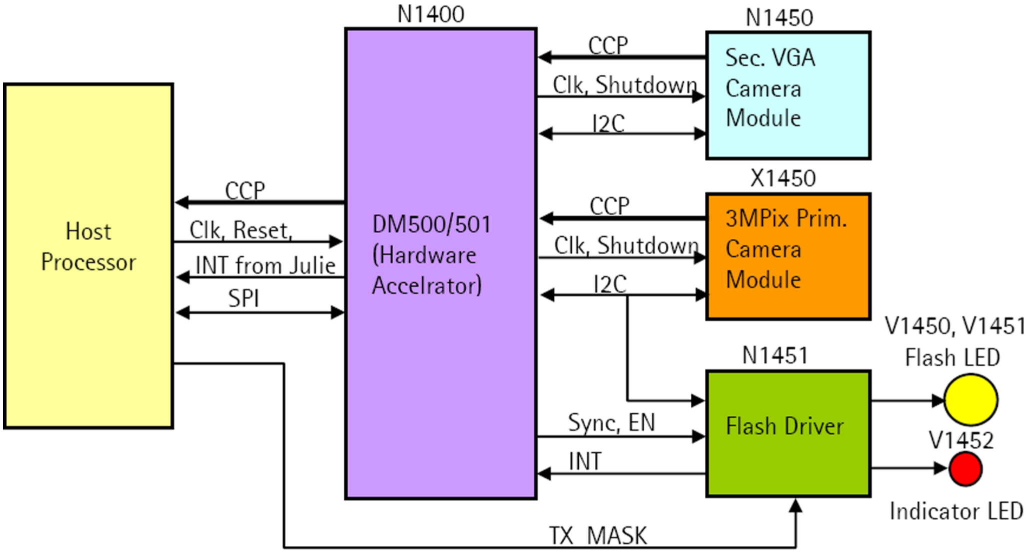

N1400
Host Processor
CCP
Clk, Reset,
INT from Julie
SPI
DM500/501 (Hardware Accelrator)
N1450
CCP
Clk, Shutdown
I2C
Sec. VGA Camera Module
X1450
CCP
Clk, Shutdown
I2C
3MPix Prim. Camera Module
N1451
Sync, EN
INT
Flash Driver
V1450, V1451
Flash LED
V1452
Indicator LED
TX_MASK

Figure 62 Imaging and video subsystem block diagram

Imaging HWA

This devices uses a separate imaging and video engine. Its main ASIC is DM500 processor (N1400), which compresses and decodes camera pictures and video stream. It is connected to the Rapido with a CCP2 serial interface for data, and SPI interface for control commands.

Two camera modules are connected to the DM500 with CCP2 interface – the 3 megapixel main camera (X1450, SMIA socket) and VGA secondary camera (N1450). The I2C bus is used for both cameras as a control interface.

The I2C is also controlling the flash driver, ADP1653 (N1451). The flash driver has a TX_MASK feature, which reduces flash current during the RF TX bursts to prevent excessive current drain from the battery.

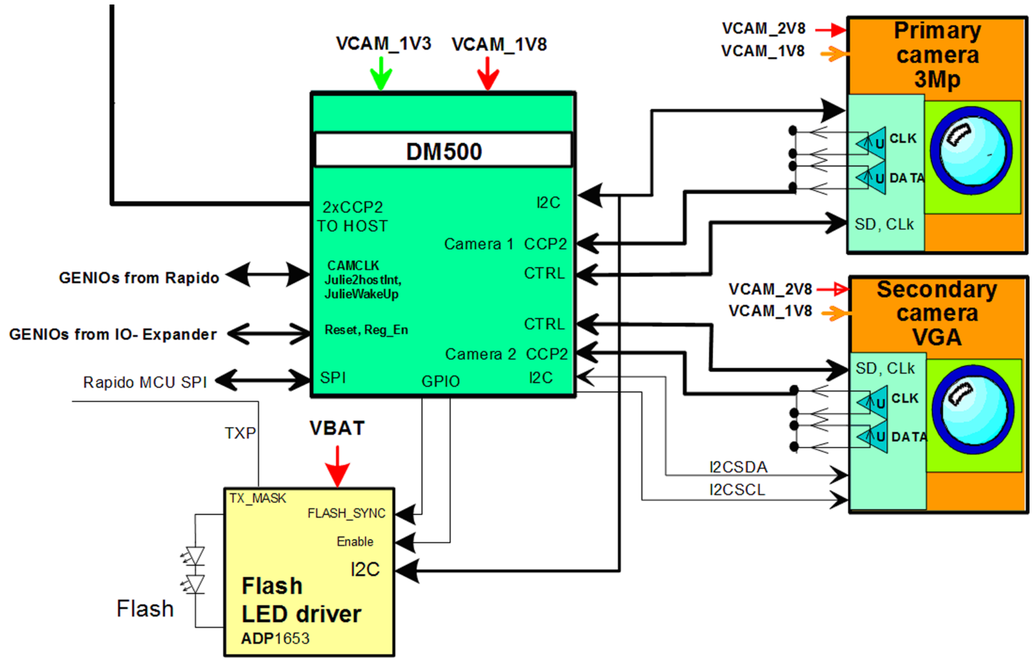

VCAM_1V3
VCAM_1V8
DM500
2xCCP2
TO HOST
I2C
Camera 1 CCP2
CTRL
CAMCLK
Julie2hostInt,
JulieWakeUp
Reset, Reg_En
CTRL
Camera 2 CCP2
SPI
GPIO
I2C
GENIOs from Rapido
GENIOs from IO- Expander
Rapido MCU SPI
TXP
VBAT
TX_MASK
FLASH_SYNC
Enable
I2C
Flash
LED driver
ADP1653
Flash
VCAM_2V8
VCAM_1V8
Primary
camera
3Mp
CLK
DATA
SD, CLk
VCAM_2V8
VCAM_1V8
Secondary
camera
VGA
SD, CLk
CLK
DATA
I2CSDA
I2CSCL

Figure 63 Imaging HWA block diagram

User interface

Resistive touch screen

Proximity sensor

The proximity sensor is used to turn off the touch input, when the phone is against user's ear during call. This prevents accidental touch signals that could happen when, for example, user's cheek touches the phone.

The main parts of the proximity sensor subsystem are:

- Proximity sensor
- Proximity boot (mechanical part)

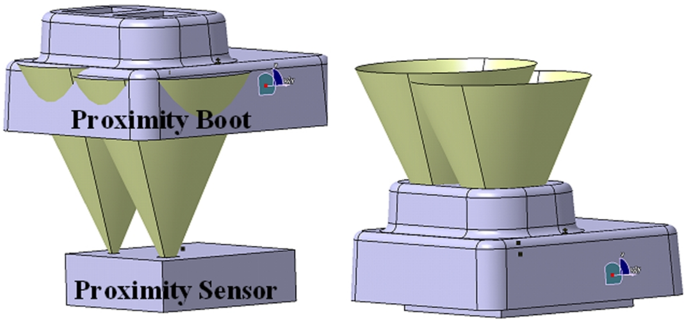

Proximity Boot
Proximity Sensor

Figure 64 Proximity sensor and boot

The proximity sensor is located on the upper flex assembly.

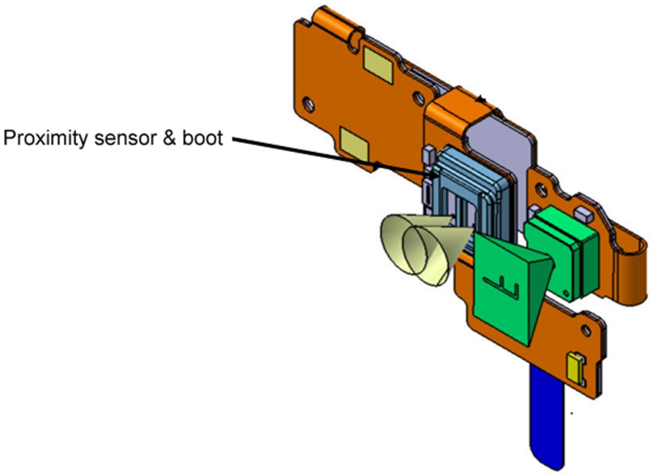

Proximity sensor & boot

Figure 65 Proximity sensor and boot location

Features

The Proximity sensor has following features:

- 2.8V
- 1.8V compatible IOs
- Low power consumption
- 20 mm working area
- Factory calibrated, no calibration required in care
- Pb free/RoHS compliancy

The proximity sensor works by sending out a beam of IR light, and then computing the distance to any nearby objects from characteristics of the returned (reflected) signal. When the object is under 20 mm distance detection will happen and output will go to high state (1.8V).

Reference design

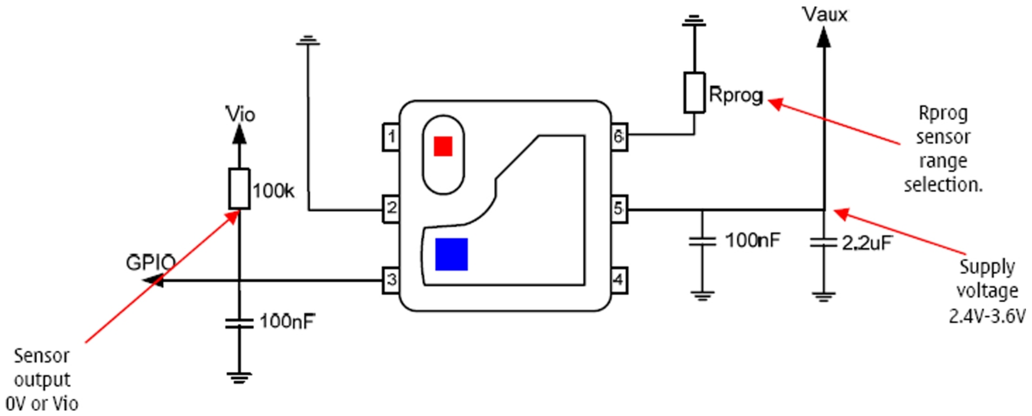

Vaux
Rprog
Rprog sensor range selection.
Vio
100k
1
2
3
4
5
6
GPIO
100nF
100nF
2.2uF
Supply voltage 2.4V-3.6V
Sensor output 0V or Vio

Figure 66 Proximity sensor reference design and measurement points

Pin	Signal name	Description
1	Anode LED	No connection
2	GND	Ground
3	OUT	Sensor output (0V or 1.8V Push-Pull)

Pin	Signal name	Description
4	TEST	No connection
5	VCC	Supply voltage (2.4V - 2.8V)
6	Rprog	Program resistor

Touch screen controller

TSC2004 (N2450) is a touch screen controller for resistive touch pads. It contains a complete ultralow-power, 12-bit, analog-to-digital (A/D) resistive touch screen converter, including drivers and control logic to measure touch pressure.

It also has embedded pre-processing function to reduce the output bus load. The host interface in TSC2004 is I2C.

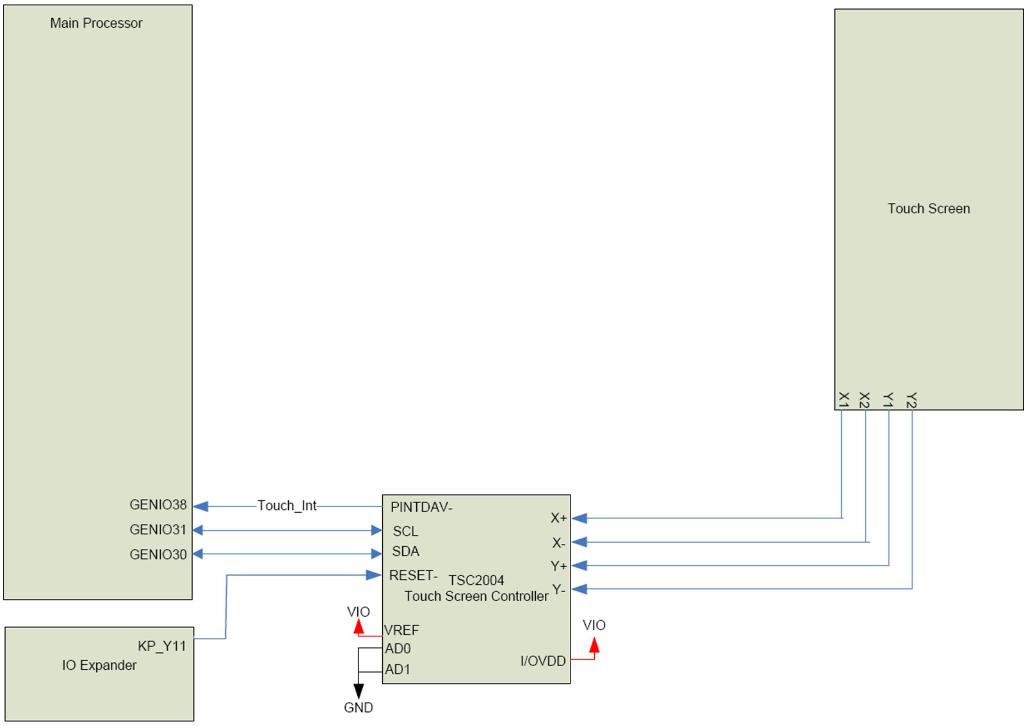

Main Processor
Touch Screen
X1
X2
Y1
Y2
GENIO38
GENIO31
GENIO30
Touch_Int
PINTDAV-
SCL
SDA
RESET-
TSC2004
Touch Screen Controller
X+
X-
Y+
Y-
VIO
VREF
AD0
AD1
GND
VIO
I/OVDD
KP_Y11
IO Expander

Figure 67 Touch screen controller

Display

Display

Rapido has an external display buffer with 8Mbit display RAM. The input interfaces for display buffer are ViSSI-12 for image data and LoSSI for commands.

The data interface between display buffer and display is CDP (Compact Display Port), display commands are sent by LoSSI interface. The display backlight control is controlled by the display.

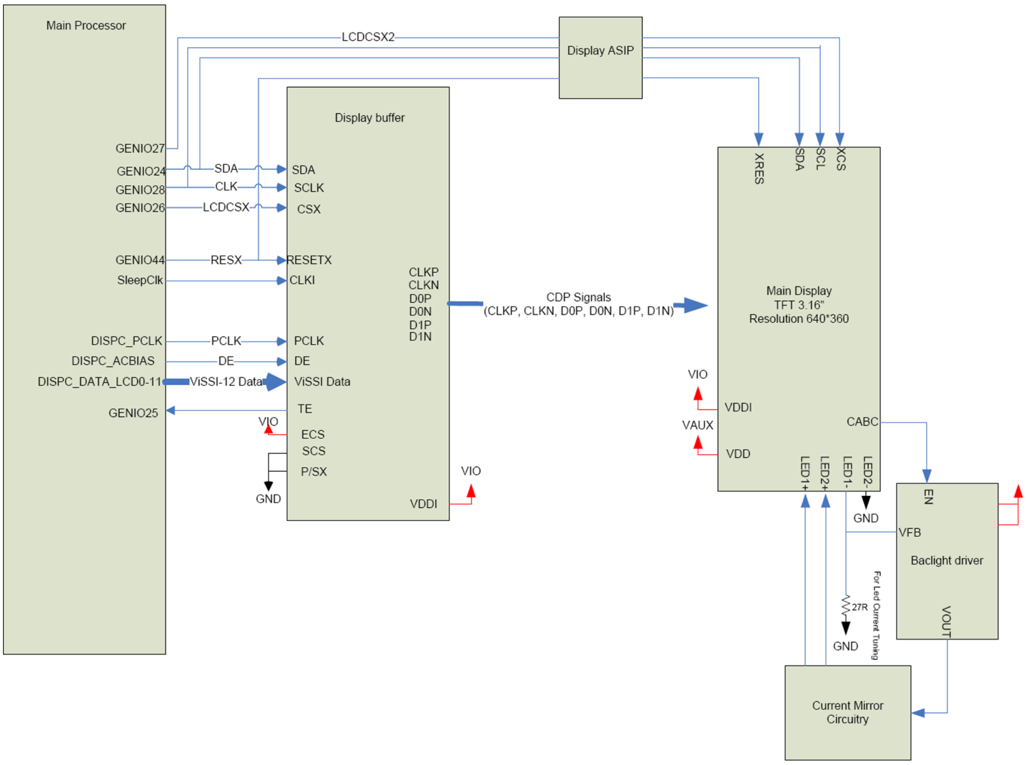

Main Processor
GENIO27
GENIO24
GENIO28
GENIO26
GENIO44
SleepClk
DISPC_PCLK
DISPC_ACBIAS
DISPC_DATA_LCD0-11
GENIO25
LCDCSX2
Display ASIP
Display buffer
SDA
CLK
LCDCSX
RESX
PCLK
DE
ViSSI-12 Data
SDA
SCLK
CSX
RESETX
CLKI
PCLK
DE
ViSSI Data
TE
VIO
ECS
SCS
P/SX
GND
VDDI
VIO
CLKP
CLKN
D0P
D0N
D1P
D1N
CDP Signals
(CLKP, CLKN, D0P, D0N, D1P, D1N)
XRES
SDA
SCL
XCS
Main Display
TFT 3.16"
Resolution 640*360
VIO
VDDI
VAUX
VDD
CABC
LED1+
LED2+
LED1-
LED2-
GND
EN
VFB
Baclight driver
VOUT
27R
For Led Current Tuning
GND
Current Mirror
Circuitry

Figure 68 Display block diagram

Backlight and illumination

This device has two backlighting systems; one for the display and one for the HW keys and other illumination zones.

Backlighting for HW keys

The L5521 LED contoller is used for backlightning the HW keys . There is one LP5521 in the reference HW making it possible to have up to three LED zones. It can also drive the RGB LED.

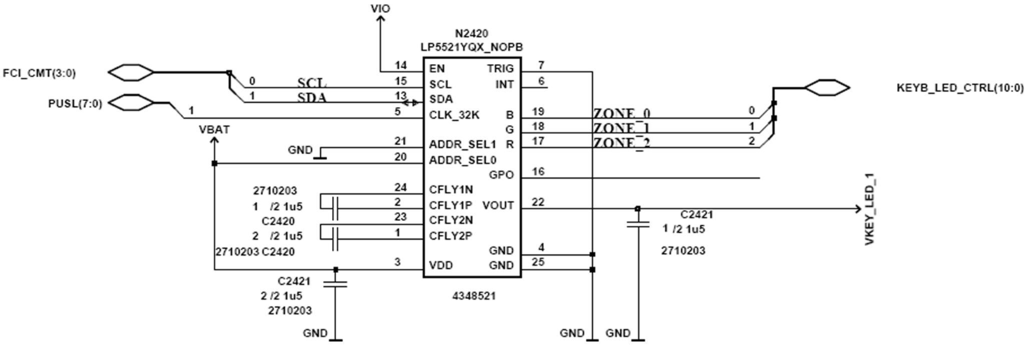

VIO
N2420
LP5521YQX_NOPB
FCI_CMT(3:0)
PUSL(7:0)
SCL
SDA
VBAT
GND
EN
SCL
SDA
CLK_32K
ADDR_SEL1
ADDR_SEL0
CFLY1N
CFLY1P
CFLY2N
CFLY2P
VDD
TRIG
INT
B
G
R
GPO
VOUT
GND
GND
ZONE_0
ZONE_1
ZONE_2
KEYB_LED_CTRL(10:0)
VKEY_LED_1
C2420
C2421
1u5
2710203
4348521
GND
GND
GND

Figure 69 Backlight control for HW keys

Display backlights

Display backlights consist of two LED chains, each containing three LEDs in series powered by TPA61061 switching mode power supply. Display backlight brightness is controlled by the CABC signal, and the equality of the current (and thus the brightness) through the two LED chains is ensured by a current mirror.

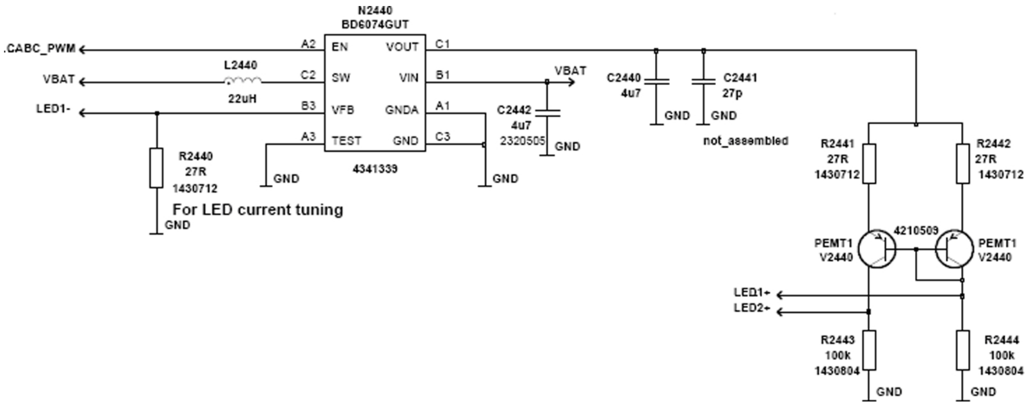

N2440
BD6074GUT
.CABC_PWM
VBAT
LED1-
L2440
22uH
A2
C2
B3
A3
EN
SW
VFB
TEST
VOUT
VIN
GNDA
GND
C1
B1
A1
C3
4341339
VBAT
C2440
4u7
C2441
27p
C2442
4u7
2320505
GND
not_assembled
R2440
27R
1430712
For LED current tuning
R2441
27R
1430712
R2442
27R
1430712
PEMT1
V2440
4210509
LED1+
LED2+
R2443
100k
1430804
R2444
100k
1430804

Figure 70 Display backlighting system

Digital Ambient Light Sensor (ALS)

The Digital Ambient Light Sensor (N6502) approximates ambient light. Ambient light level together with CABC and user settings adjust the display and keyboard illumination brightness. The Ambient Light Sensor is located on the upper flex.

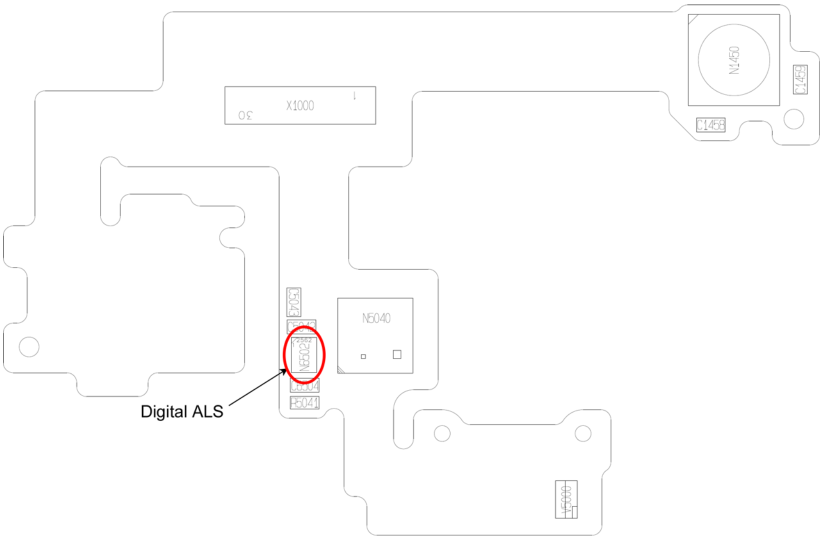

X1000
N1450
C1456
N5040
Digital ALS

Figure 71 Digital Ambient Light Sensor location

It is connected to the I2C bus, and powered by the VOUT (2.5V) voltage.

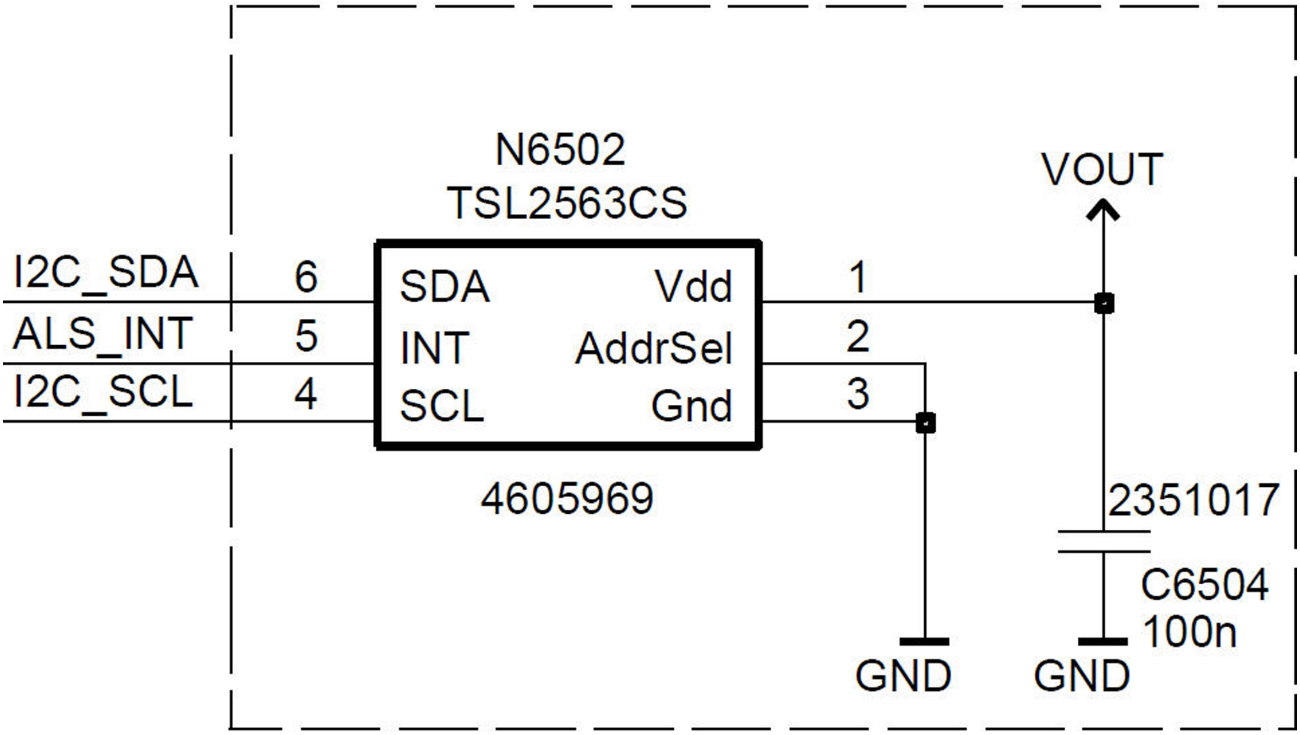

N6502
TSL2563CS
I2C_SDA
ALS_INT
I2C_SCL
6
5
4
SDA
INT
SCL
Vdd
AddrSel
Gnd
1
2
3
VOUT
4605969
2351017
C6504
100n
GND
GND

Figure 72 Digital Ambient light sensor schematics

ASICs

RAPIDOYAWE

RAPIDOYAWE ASIC (D2800) is a die-stacked Processor (RAPIDO) with 3G HDSPA logic (YAWE). RAM memory is integrated into RAPIDO.

EM ASIC N2300 (Betty)

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED driver for backlights
- Digital interface (CBUS)

EM ASIC N2200 (Avilma)

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers

- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) is stacked on top of Vilma (hence called AVilma). It includes biasing passives for microphones and EMC filters for SIM, microphones etc.

Device memories

Combo memory

The memory consists of DDR SDRAM and MuxedMassMemory (M3)(NAND) combined into a single package. Memory capacity is 1Gb DDR and 2Gb M3.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around three ASICs: RAPIDOYAWE engine ASIC, mixed signal ASIC Avilma and D/A converter DAC33.

DAC33 converts digital audio data to analogue signal, and TPA6130 audio amplifier provides an interface for the accessory connector.

AVilma provides analogue signal for earpiece and for D-class audio amplifier TPA2012D2, which drives the integrated stereo handsfree speakers.

There are four audio transducers:

- Earpiece
- Two speakers
- Digital MEMS (Microelectromechanical systems) microphone

Avilma provides an output for the dynamic vibra component.

All wired audio accessories are connected to the AV accessory connector.

The Bluetooth audio and FM radio module, which is connected to the RAPIDOYAWE, supports Bluetooth audio and FM radio functionality.

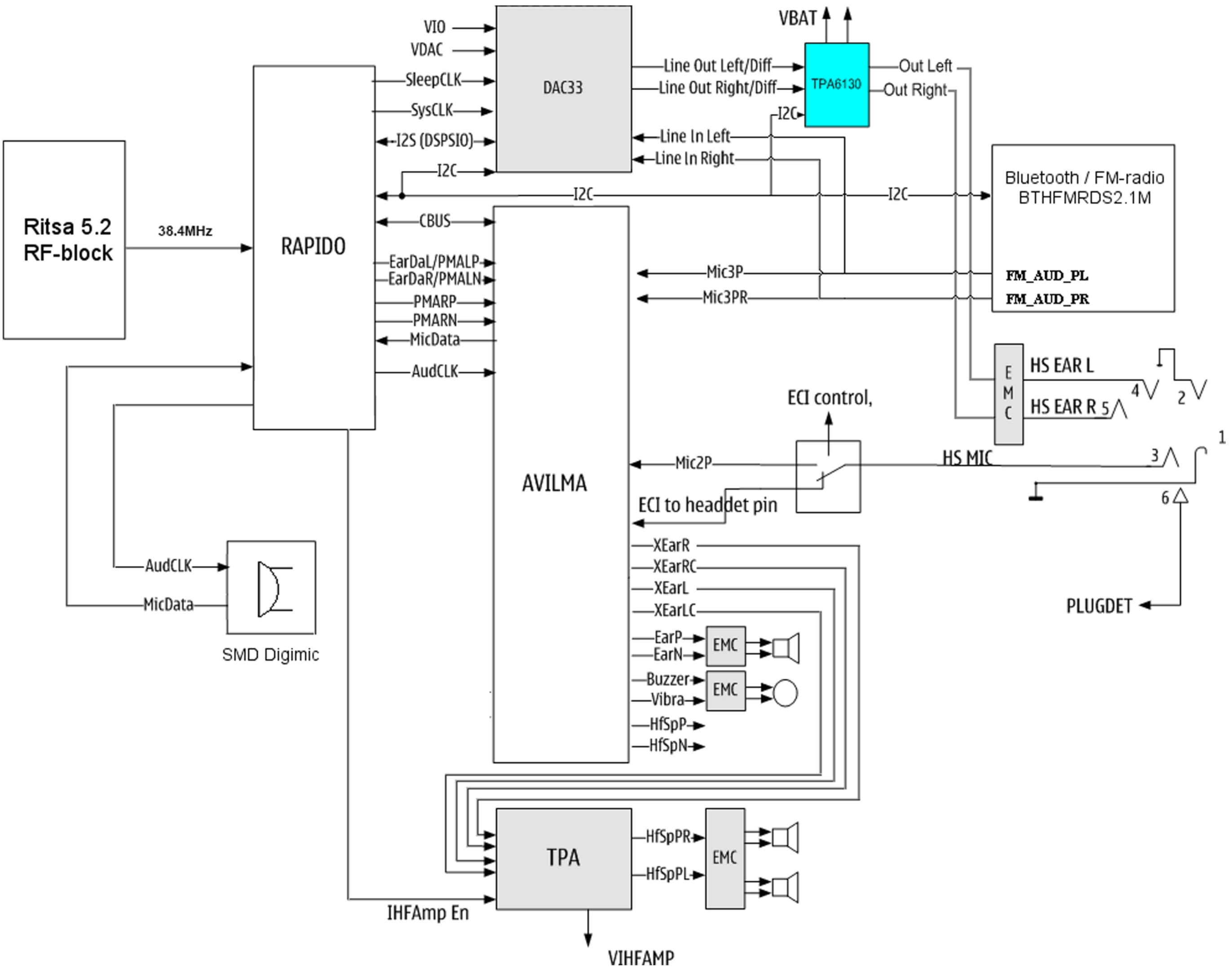

VIO
VDAC
SleepCLK
SysCLK
I2S (DSPSIO)
I2C
DAC33
VBAT
Line Out Left/Diff
Line Out Right/Diff
TPA6130
Out Left
Out Right
I2C
Line In Left
Line In Right
I2C
I2C
Bluetooth / FM-radio
BTHFMRDS2.1M
FM_AUD_PL
FM_AUD_PR
Ritsa 5.2
RF-block
38.4MHz
RAPIDO
CBUS
EarDaL/PMALP
EarDaR/PMALN
PMARP
PMARN
MicData
AudCLK
AVILMA
Mic3P
Mic3PR
E
M
C
HS EAR L
HS EAR R
4
2
5
ECI control,
Mic2P
HS MIC
3
1
6
ECI to headset pin
XEarR
XEarRC
XEarL
XEarLC
EarP
EarN
EMC
Buzzer
Vibra
EMC
HfSpP
HfSpN
PLUGDET
AudCLK
MicData
SMD Digimic
TPA
HfSpPR
HfSpPL
EMC
IHFAmp En
VIHFAMP

Figure 73 Audio block diagram

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes. A digital MEMS microphone data and clock line are connected to RAPIDOYAWE and the operating voltage 3V is received from Avilma.

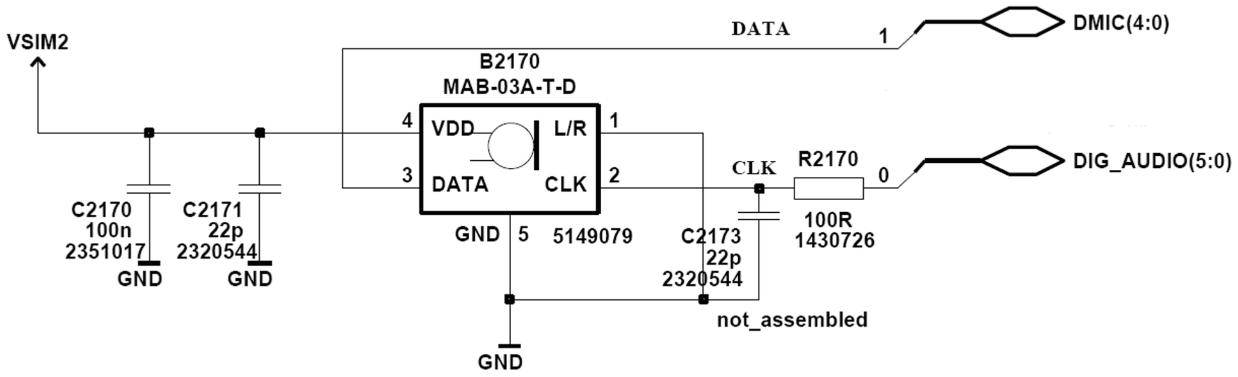

VSIM2
DATA
1
DMIC(4:0)
B2170
MAB-03A-T-D
4
VDD
L/R
1
3
DATA
CLK
2
GND
5
5149079
CLK
R2170
0
DIG_AUDIO(5:0)
100R
1430726
C2170
100n
2351017
GND
C2171
22p
2320544
GND
C2173
22p
2320544
not_assembled
GND

Figure 74 Internal microphone

External microphone

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by Avilma ASIC MicB2 bias voltage output. The circuitry provides an asymmetrical connection for the microphone from the AV connector, XMICP to Avilma ASIC input, mic2p and XMICN, to GND.

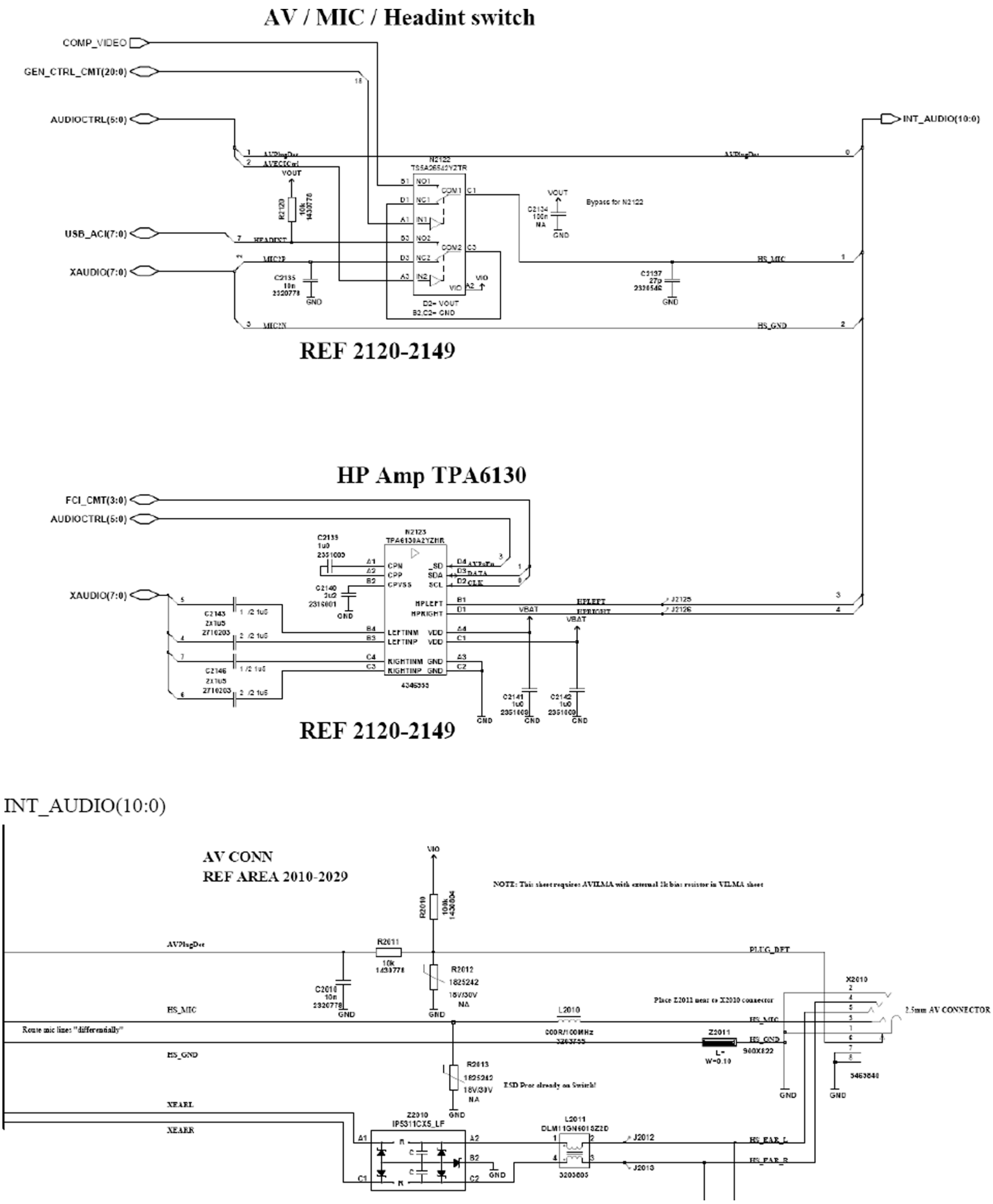

AV / MIC / Headint switch
COMP_VIDEO
GEN_CTRL_CMT(20:0)
AUDIOCTRL(6:0)
INT_AUDIO(10:0)
USB_ACI(7:0)
XAUDIO(7:0)
N2122
TS5A26542YZTR
R2120
10k
1430778
VOUT
C2134
100n
NA
GND
Bypass for N2122
C2135
10n
2320778
C2137
27p
2320546
HS_MIC
HS_GND
D2= VOUT
B2,C2= GND
REF 2120-2149
HP Amp TPA6130
FCI_CMT(3:0)
AUDIOCTRL(6:0)
XAUDIO(7:0)
N2123
TPA6130A2YZHR
C2139
1u0
2351003
C2140
2u2
2316001
C2143
2x1u5
2710203
C2146
2x1u5
2710203
HPLEFT
HPRIGHT
LEFTINM
LEFTINP
RIGHTINM
RIGHTINP
VBAT
C2141
1u0
2351003
C2142
1u0
2351003
J2125
J2126
4346333
GND
REF 2120-2149
INT_AUDIO(10:0)
AV CONN
REF AREA 2010-2029
VIO
R2010
100k
1430804
NOTE: This sheet requires AVILMA with external 1k bias resistor in VILMA sheet
AVPlugDet
R2011
10k
1430778
R2012
1825242
18V/30V
NA
PLUG_DET
C2010
10n
2320778
HS_MIC
Route mic lines "differentially"
HS_GND
L2010
600R/100MHz
Place Z2011 near to X2030 connector
Z2011
900X822
L=
W=0.10
X2010
2.5mm AV CONNECTOR
5463848
R2013
1825242
18V/30V
NA
ESD Prot already on Switch!
XEARL
XEARR
Z2010
IP5311CX5_LF
L2011
DLM11GN601SZ2D
3203003
J2012
J2013
HS_EAR_L
HS_EAR_R
GND

Figure 75 External earpiece and microphone circuitry (AV connected on the right)

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. The earpiece capsule is connected to Avilma ASIC's differential output EarP and EarN.

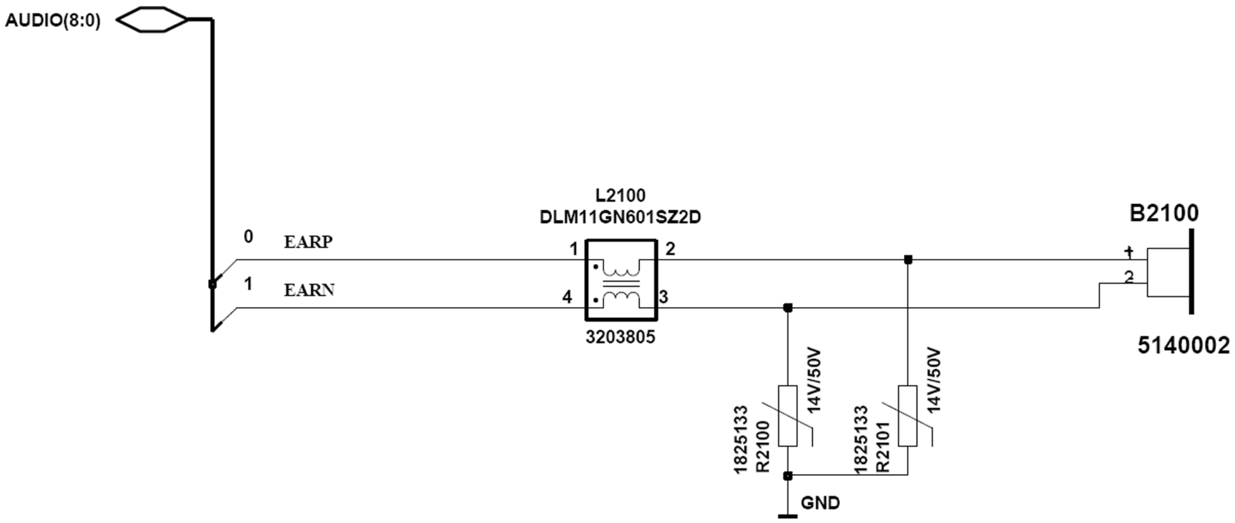

AUDIO(8:0)
0
EARP
1
EARN
L2100
DLM11GN601SZ2D
1
2
4
3
3203805
B2100
+
2
5140002
14V/50V
1825133
R2100
14V/50V
1825133
R2101
GND

Figure 76 Internal earpiece circuitry

Internal speakers

Internal speakers is used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening.

The two speakers are connected to Avilma ASIC’s outputs XearR/XearL via the stereo D-class IHF amplifier TPA2012D2. The amplifier has 24 dB fixed gain and it is put to shutdown mode when not in use.

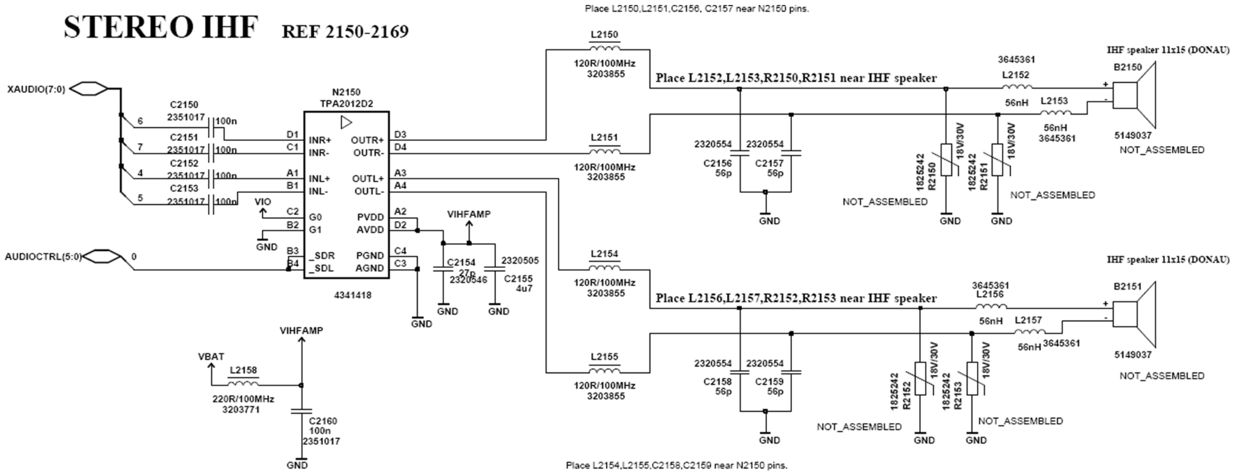

STEREO IHF
REF 2150-2169
Place L2150,L2151,C2156, C2157 near N2150 pins.
XAUDIO(7:0)
6
7
4
5
C2150
2351017
100n
C2151
2351017
100n
C2152
2351017
100n
C2153
2351017
100n
N2150
TPA2012D2
D1
C1
A1
B1
C2
B2
B3
B4
INR+
INR-
INL+
INL-
G0
G1
_SDR
_SDL
OUTR+
OUTR-
OUTL+
OUTL-
PVDD
AVDD
PGND
AGND
D3
D4
A3
A4
A2
D2
C4
C3
4341418
VIO
GND
AUDIOCTRL(5:0)
0
VIHFAMP
C2154
27p
2320546
2320505
C2155
4u7
GND
GND
GND
VIHFAMP
VBAT
L2158
220R/100MHz
3203771
C2160
100n
2351017
GND
L2150
120R/100MHz
3203855
L2151
120R/100MHz
3203855
L2154
120R/100MHz
3203855
L2155
120R/100MHz
3203855
Place L2152,L2153,R2150,R2151 near IHF speaker
2320554
C2156
56p
2320554
C2157
56p
GND
3645361
L2152
56nH
L2153
56nH
3645361
1825242
R2150
18V/30V
1825242
R2151
18V/30V
NOT_ASSEMBLED
NOT_ASSEMBLED
GND
GND
IHF speaker 11x15 (DONAU)
B2150
+
-
5149037
NOT_ASSEMBLED
Place L2156,L2157,R2152,R2153 near IHF speaker
2320554
C2158
56p
2320554
C2159
56p
GND
3645361
L2156
56nH
L2157
56nH
3645361
1825242
R2152
18V/30V
1825242
R2153
18V/30V
NOT_ASSEMBLED
NOT_ASSEMBLED
GND
GND
IHF speaker 11x15 (DONAU)
B2151
+
-
5149037
NOT_ASSEMBLED
Place L2154,L2155,C2158,C2159 near N2150 pins.

Figure 77 Internal speakers' circuitry

External earpiece

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

The Avilma ASIC provides two output channels in either single-ended or differential format. The Avilma ASIC outputs XearL and XearLC form the left channel audio output, and XearR and XearRC from the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

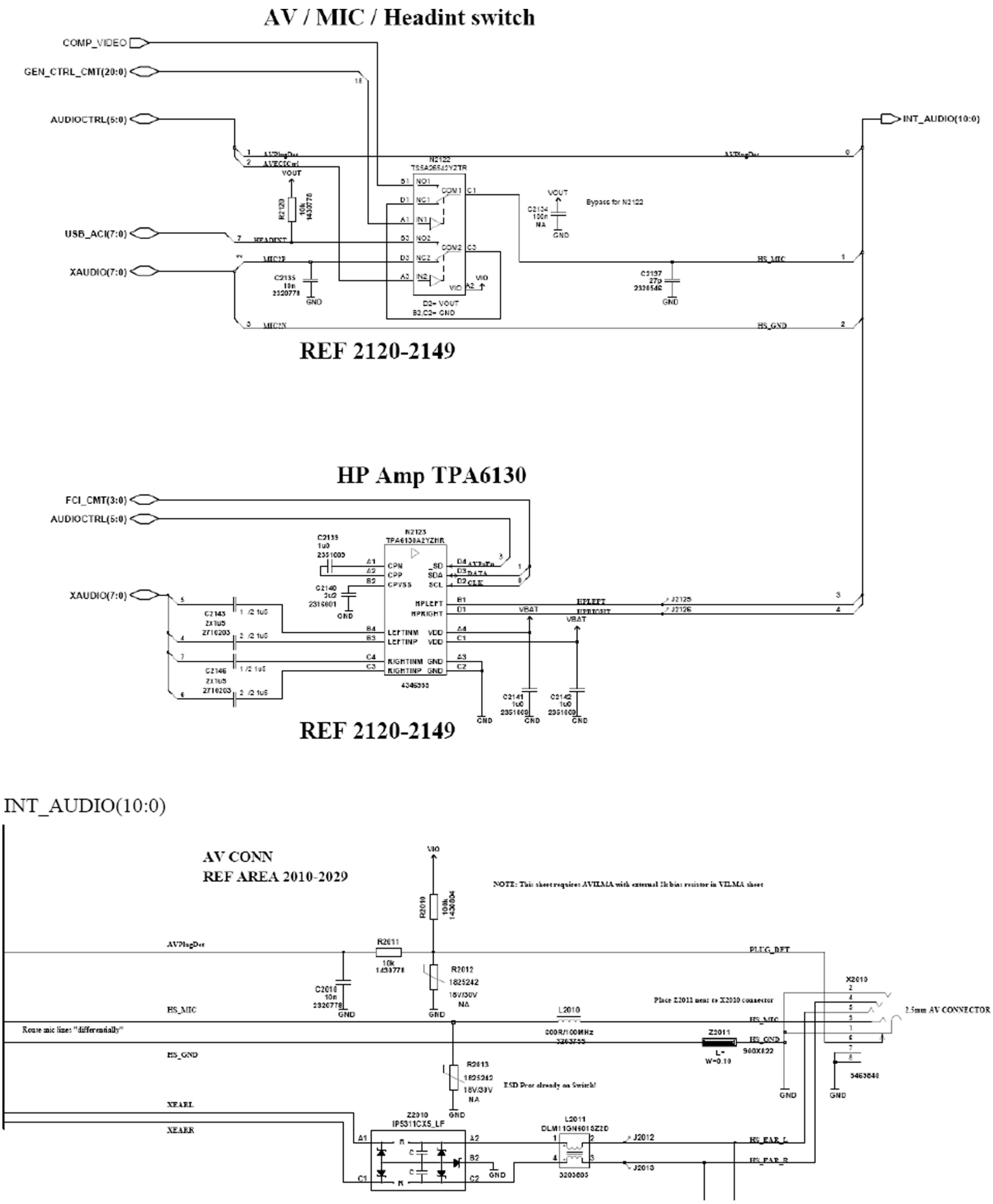

AV / MIC / Headint switch
COMP_VIDEO
GEN_CTRL_CMT(20:0)
AUDIOCTRL(5:0)
USB_ACI(7:0)
XAUDIO(7:0)
INT_AUDIO(10:0)
N2122
TS5A26542YZTR
R2120
C2135
C2134
C2137
Bypass for N2122
HS_MIC
HS_GND
REF 2120-2149
HP Amp TPA6130
FCI_CMT(3:0)
AUDIOCTRL(5:0)
XAUDIO(7:0)
N2123
TPA6130A2YZHR
C2139
C2140
C2143
C2146
C2141
C2142
VBAT
HPLEFT
HPRIGHT
J2125
J2126
REF 2120-2149
INT_AUDIO(10:0)
AV CONN
REF AREA 2010-2029
VIO
R2010
R2011
R2012
R2013
C2010
L2010
Z2011
Z2010
IP5311CX5_LF
L2011
J2012
J2013
X2010
2.5mm AV CONNECTOR
AVPlugDet
PLUG_DET
HS_MIC
HS_GND
XEARL
XEARR
HS_EAR_L
HS_EAR_R
Route mic lines "differentially"
Place Z2011 near to X2010 connector
ESD Prot already on Switch!
GND

Figure 78 External earpiece and microphone circuitry (AV connected on the right)

Vibra

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

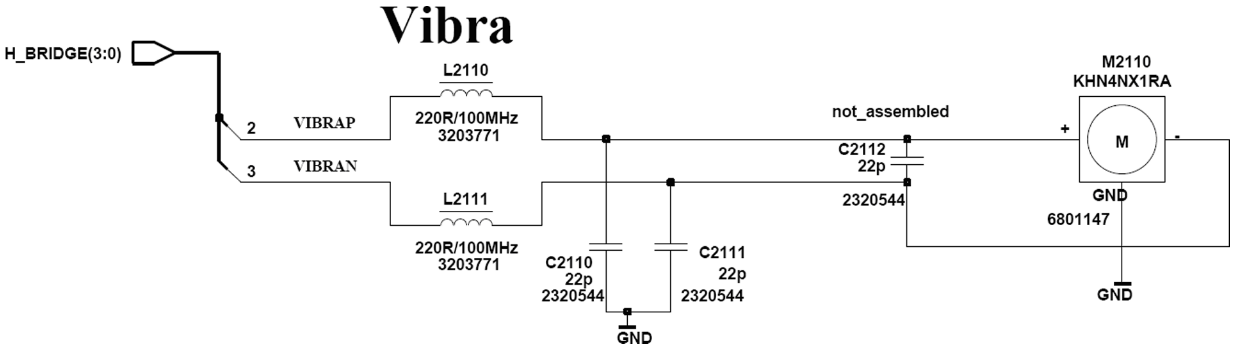

Vibra
H_BRIDGE(3:0)
2
VIBRAP
3
VIBRAN
L2110
220R/100MHz
3203771
L2111
220R/100MHz
3203771
C2110
22p
2320544
C2111
22p
2320544
GND
not_assembled
C2112
22p
2320544
M2110
KHN4NX1RA
+
M
-
GND
6801147
GND

Figure 79 Vibra circuitry

AV connector

The following features are supported by the engine accessory interface:

- PlugDet signal is grounded when 3.5mm plug is inserted into the AV connector
- Audio output (stereo headset/headphones having the impedance >16ohm)

  - DAC33 signal source, TPA6130 two channel audio amplifier
- Audio input (mono microphone from headset)

  - Analogue microphone output Mic2P to AVilma
- Control data (ECI)

  - Used by AVilma/RAPIDOYAWE for accessory identification when the 3.5mm plug is detected
- TV out composite signal to 75ohm coax cable

  - Composite signal is routed to AV connector through a switch (which is controlled by AVVideoCtrl signal) when TV is detected
- Connects FM receiver to headphones, which serve as FM antenna

  - Lines 4 & 5, through the bandpass filter

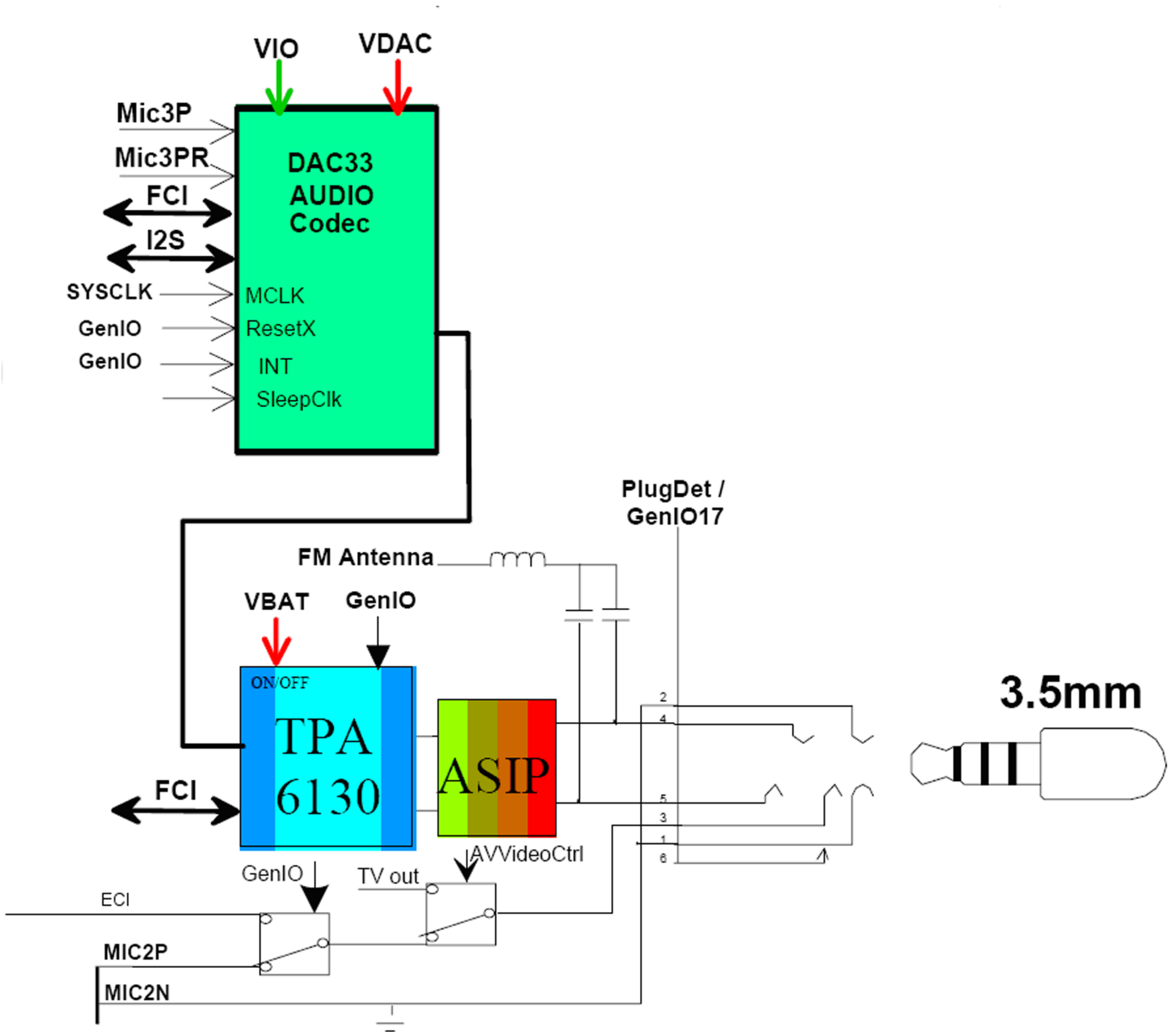

VIO
VDAC
Mic3P
Mic3PR
FCI
I2S
SYSCLK
GenIO
GenIO
DAC33
AUDIO
Codec
MCLK
ResetX
INT
SleepClk
PlugDet /
GenIO17
FM Antenna
VBAT
GenIO
ON/OFF
TPA
6130
ASIP
3.5mm
FCI
GenIO
TV out
AVVideoCtrl
ECI
MIC2P
MIC2N
2
4
5
3
1
6

Figure 80 Accessory (AV) connector with DAC33 and TPA6130 audio enhancements

Baseband technical specifications

External interfaces

Name of Connection	Connector reference
USB	X3300 (on engine PWB)
Charger	X2000
Headset/AV	X2010
SIM	X2700 (on engine PWB)
MicroSD	X3200 (on engine PWB)
Battery connection	X2070 (on engine PWB)

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output
SW	SIM_DET	In	EM ASIC N2200	SIMDetX	Removal detection

Charging interface connections & electrical characteristics

Table 16 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 17 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	

Internal interfaces

Name of Connection	Connector reference
Earpiece	B2100
Display connector	X2450
Keypad connector	X2500

Name of Connection	Connector reference
IHF speakers	B2150 B2151
Main camera connector	X1490
Microphone	B2170 (on engine PWB)
2nd camera	N1460
Vibra	X2110
Flash	X1480

Back-up battery interface electrical characteristics

Table 18 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200

Table 19 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.6	3.3	V

RF description

Block diagram

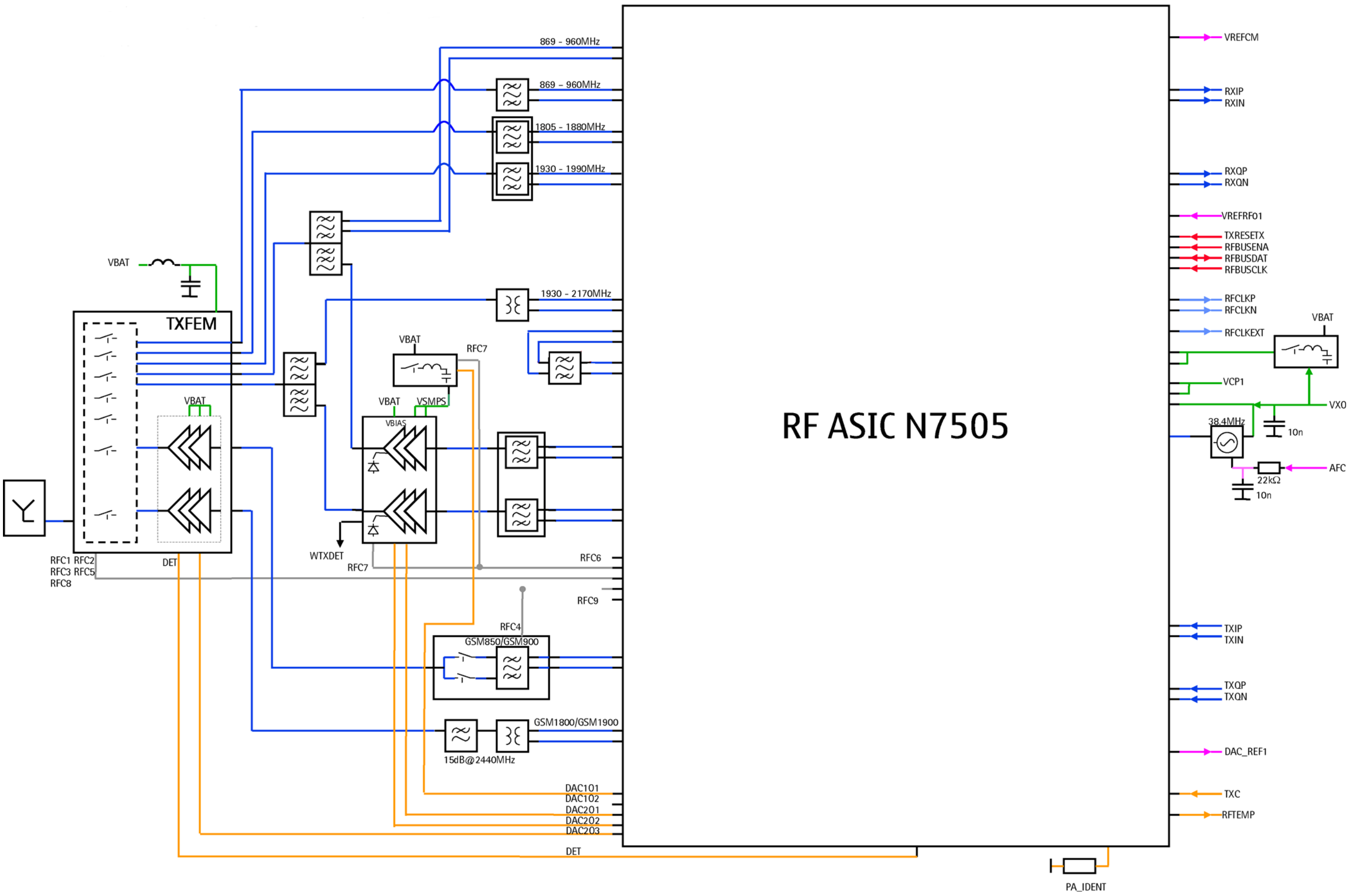

869 - 960MHz
869 - 960MHz
1805 - 1880MHz
1930 - 1990MHz
VBAT
TXFEM
1930 - 2170MHz
VBAT
RFC7
VBAT
VSMPS
VBAT
VBIAS
RF ASIC N7505
WTXDET
RFC7
RFC6
RFC9
RFC1 RFC2
RFC3 RFC5
RFC8
DET
RFC4
GSM850/GSM900
GSM1800/GSM1900
15dB@2440MHz
DAC101
DAC102
DAC201
DAC202
DAC203
DET
PA_IDENT
VREFCM
RXIP
RXIN
RXQP
RXQN
VREFRF01
TXRESETX
RFBUSENA
RFBUSDAT
RFBUSCLK
RFCLKP
RFCLKN
RFCLKEXT
VBAT
VCP1
VXO
38.4MHz
10n
AFC
22kΩ
10n
TXIP
TXIN
TXQP
TXQN
DAC_REF1
TXC
RFTEMP

Figure 81 RF block diagram using RF ASIC N7505

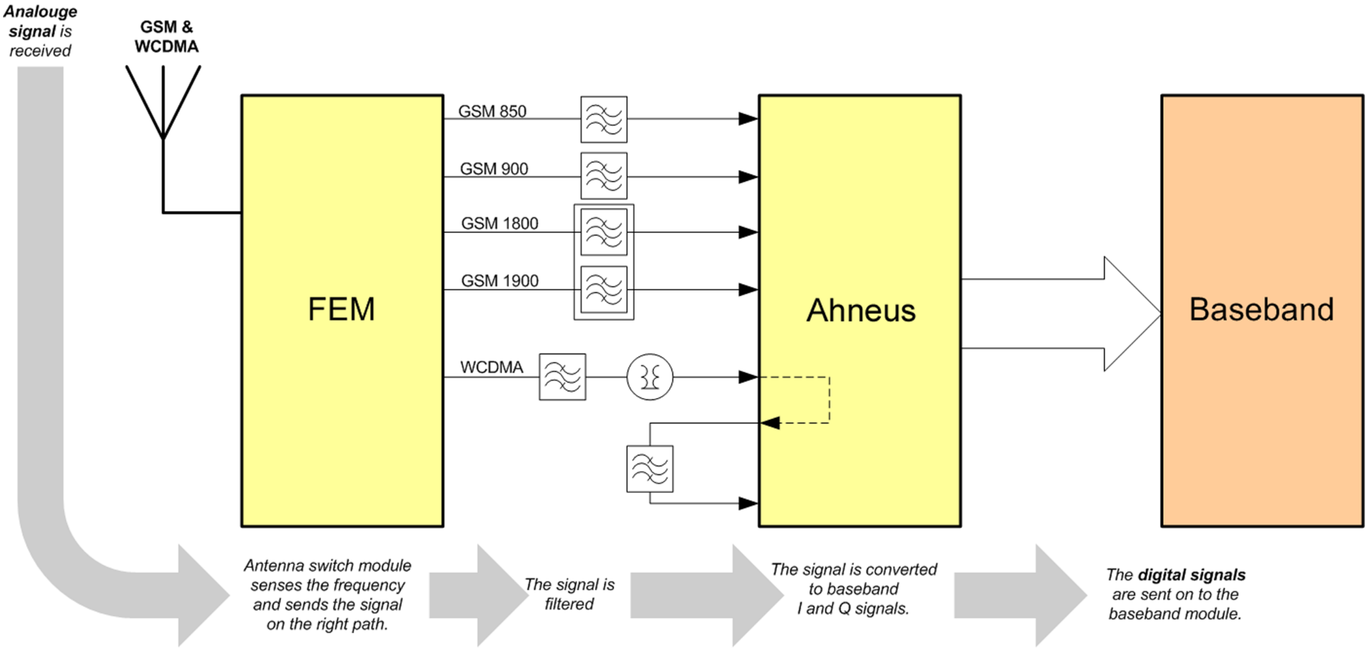
The RF block diagram uses RF ASIC N7505 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different routes, being handled by different components. The principle of GSM and WCDMA is the same.

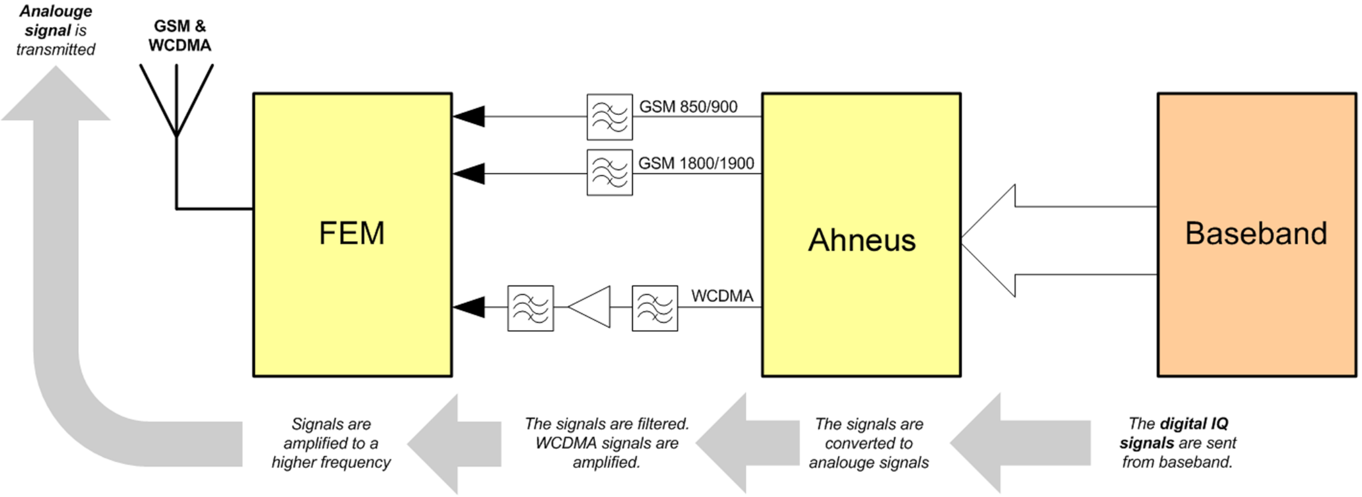

Analouge signal is received
GSM & WCDMA
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
WCDMA
Ahneus
Baseband
Antenna switch module senses the frequency and sends the signal on the right path.
The signal is filtered
The signal is converted to baseband I and Q signals.
The **digital signals** are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals pass different components, the principles of the transmission is the same.


Analouge signal is transmitted
GSM & WCDMA
FEM
GSM 850/900
GSM 1800/1900
WCDMA
Ahneus
Baseband
Signals are amplified to a higher frequency
The signals are filtered. WCDMA signals are amplified.
The signals are converted to analouge signals
The **digital IQ signals** are sent from baseband.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

WCDMA VIII (900) frequencies

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2712	882,4	3529,6	2937	927,4	3709,6
2713	882,6	3530,4	2938	927,6	3710,4
2714	882,8	3531,2	2939	927,8	3711,2
2715	883	3532	2940	928	3712
2716	883,2	3532,8	2941	928,2	3712,8
2717	883,4	3533,6	2942	928,4	3713,6
2718	883,6	3534,4	2943	928,6	3714,4
2719	883,8	3535,2	2944	928,8	3715,2
2720	884	3536	2945	929	3716
2721	884,2	3536,8	2946	929,2	3716,8
2722	884,4	3537,6	2947	929,4	3717,6
2723	884,6	3538,4	2948	929,6	3718,4
2724	884,8	3539,2	2949	929,8	3719,2
2725	885	3540	2950	930	3720
2726	885,2	3540,8	2951	930,2	3720,8
2727	885,4	3541,6	2952	930,4	3721,6
2728	885,6	3542,4	2953	930,6	3722,4
2729	885,8	3543,2	2954	930,8	3723,2
2730	886	3544	2955	931	3724
2731	886,2	3544,8	2956	931,2	3724,8
2732	886,4	3545,6	2957	931,4	3725,6
2733	886,6	3546,4	2958	931,6	3726,4
2734	886,8	3547,2	2959	931,8	3727,2
2735	887	3548	2960	932	3728
2736	887,2	3548,8	2961	932,2	3728,8
2737	887,4	3549,6	2962	932,4	3729,6
2738	887,6	3550,4	2963	932,6	3730,4
2739	887,8	3551,2	2964	932,8	3731,2
2740	888	3552	2965	933	3732
2741	888,2	3552,8	2966	933,2	3732,8
2742	888,4	3553,6	2967	933,4	3733,6
2743	888,6	3554,4	2968	933,6	3734,4
2744	888,8	3555,2	2969	933,8	3735,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2745	889	3556	2970	934	3736
2746	889,2	3556,8	2971	934,2	3736,8
2747	889,4	3557,6	2972	934,4	3737,6
2748	889,6	3558,4	2973	934,6	3738,4
2749	889,8	3559,2	2974	934,8	3739,2
2750	890	3560	2975	935	3740
2751	890,2	3560,8	2976	935,2	3740,8
2752	890,4	3561,6	2977	935,4	3741,6
2753	890,6	3562,4	2978	935,6	3742,4
2754	890,8	3563,2	2979	935,8	3743,2
2755	891	3564	2980	936	3744
2756	891,2	3564,8	2981	936,2	3744,8
2757	891,4	3565,6	2982	936,4	3745,6
2758	891,6	3566,4	2983	936,6	3746,4
2759	891,8	3567,2	2984	936,8	3747,2
2760	892	3568	2985	937	3748
2761	892,2	3568,8	2986	937,2	3748,8
2762	892,4	3569,6	2987	937,4	3749,6
2763	892,6	3570,4	2988	937,6	3750,4
2764	892,8	3571,2	2989	937,8	3751,2
2765	893	3572	2990	938	3752
2766	893,2	3572,8	2991	938,2	3752,8
2767	893,4	3573,6	2992	938,4	3753,6
2768	893,6	3574,4	2993	938,6	3754,4
2769	893,8	3575,2	2994	938,8	3755,2
2770	894	3576	2995	939	3756
2771	894,2	3576,8	2996	939,2	3756,8
2772	894,4	3577,6	2997	939,4	3757,6
2773	894,6	3578,4	2998	939,6	3758,4
2774	894,8	3579,2	2999	939,8	3759,2
2775	895	3580	3000	940	3760
2776	895,2	3580,8	3001	940,2	3760,8
2777	895,4	3581,6	3002	940,4	3761,6
2778	895,6	3582,4	3003	940,6	3762,4
2779	895,8	3583,2	3004	940,8	3763,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2780	896	3584	3005	941	3764
2781	896,2	3584,8	3006	941,2	3764,8
2782	896,4	3585,6	3007	941,4	3765,6
2783	896,6	3586,4	3008	941,6	3766,4
2784	896,8	3587,2	3009	941,8	3767,2
2785	897	3588	3010	942	3768
2786	897,2	3588,8	3011	942,2	3768,8
2787	897,4	3589,6	3012	942,4	3769,6
2788	897,6	3590,4	3013	942,6	3770,4
2789	897,8	3591,2	3014	942,8	3771,2
2790	898	3592	3015	943	3772
2791	898,2	3592,8	3016	943,2	3772,8
2792	898,4	3593,6	3017	943,4	3773,6
2793	898,6	3594,4	3018	943,6	3774,4
2794	898,8	3595,2	3019	943,8	3775,2
2795	899	3596	3020	944	3776
2796	899,2	3596,8	3021	944,2	3776,8
2797	899,4	3597,6	3022	944,4	3777,6
2798	899,6	3598,4	3023	944,6	3778,4
2799	899,8	3599,2	3024	944,8	3779,2
2800	900	3600	3025	945	3780
2801	900,2	3600,8	3026	945,2	3780,8
2802	900,4	3601,6	3027	945,4	3781,6
2803	900,6	3602,4	3028	945,6	3782,4
2804	900,8	3603,2	3029	945,8	3783,2
2805	901	3604	3030	946	3784
2806	901,2	3604,8	3031	946,2	3784,8
2807	901,4	3605,6	3032	946,4	3785,6
2808	901,6	3606,4	3033	946,6	3786,4
2809	901,8	3607,2	3034	946,8	3787,2
2810	902	3608	3035	947	3788
2811	902,2	3608,8	3036	947,2	3788,8
2812	902,4	3609,6	3037	947,4	3789,6
2813	902,6	3610,4	3038	947,6	3790,4
2814	902,8	3611,2	3039	947,8	3791,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2815	903	3612	3040	948	3792
2816	903,2	3612,8	3041	948,2	3792,8
2817	903,4	3613,6	3042	948,4	3793,6
2818	903,6	3614,4	3043	948,6	3794,4
2819	903,8	3615,2	3044	948,8	3795,2
2820	904	3616	3045	949	3796
2821	904,2	3616,8	3046	949,2	3796,8
2822	904,4	3617,6	3047	949,4	3797,6
2823	904,6	3618,4	3048	949,6	3798,4
2824	904,8	3619,2	3049	949,8	3799,2
2825	905	3620	3050	950	3800
2826	905,2	3620,8	3051	950,2	3800,8
2827	905,4	3621,6	3052	950,4	3801,6
2828	905,6	3622,4	3053	950,6	3802,4
2829	905,8	3623,2	3054	950,8	3803,2
2830	906	3624	3055	951	3804
2831	906,2	3624,8	3056	951,2	3804,8
2832	906,4	3625,6	3057	951,4	3805,6
2833	906,6	3626,4	3058	951,6	3806,4
2834	906,8	3627,2	3059	951,8	3807,2
2835	907	3628	3060	952	3808
2836	907,2	3628,8	3061	952,2	3808,8
2837	907,4	3629,6	3062	952,4	3809,6
2838	907,6	3630,4	3063	952,6	3810,4
2839	907,8	3631,2	3064	952,8	3811,2
2840	908	3632	3065	953	3812
2841	908,2	3632,8	3066	953,2	3812,8
2842	908,4	3633,6	3067	953,4	3813,6
2843	908,6	3634,4	3068	953,6	3814,4
2844	908,8	3635,2	3069	953,8	3815,2
2845	909	3636	3070	954	3816
2846	909,2	3636,8	3071	954,2	3816,8
2847	909,4	3637,6	3072	954,4	3817,6
2848	909,6	3638,4	3073	954,6	3818,4
2849	909,8	3639,2	3074	954,8	3819,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2850	910	3640	3075	955	3820
2851	910,2	3640,8	3076	955,2	3820,8
2852	910,4	3641,6	3077	955,4	3821,6
2853	910,6	3642,4	3078	955,6	3822,4
2854	910,8	3643,2	3079	955,8	3823,2
2855	911	3644	3080	956	3824
2856	911,2	3644,8	3081	956,2	3824,8
2857	911,4	3645,6	3082	956,4	3825,6
2858	911,6	3646,4	3083	956,6	3826,4
2859	911,8	3647,2	3084	956,8	3827,2
2860	912	3648	3085	957	3828
2861	912,2	3648,8	3086	957,2	3828,8
2862	912,4	3649,6	3087	957,4	3829,6
2863	912,6	3650,4	3088	957,6	3830,4

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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